JPRS-UAC-90-010
24 OCTOBER 1990

JPRS Report

Soviet Union

AVIATION & COSMONAUTICS

No 6, June 1990

Soviet Union
AVIATION AND COSMONAUTICS
No 6, June 1990

JPRS-UAC-90-010 *24 October 1990*

CONTENTS

[The following are translations of selected articles in the Russian-language monthly journal AVIATSIYA I KOSMONAVTIKA published in Moscow. Refer to the table of contents for a listing of any articles not translated.]

AVIATION AND COSMONAUTICS

No 6, June 1990

Help Improve the Air Force

90SV0038A Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 90 (signed to press 29 Apr 90) pp 2-3

[Article, published under the heading "Frank Conversation at the Editors' Initiative," by Twice Hero of the Soviet Union Mar Avn A. Yefimov, commander in chief of the Air Force, and Lt Gen Avn G. Benov, member, Military Council, chief of Air Force Political Directorate: "Help Improve the Air Force"]

[Text] **The magazine AVIATSIYA I KOSMONAVTIKA should help improve the Air Force. This point becomes particularly important in connection with the initiated military reform.**

The magazine AVIATSIYA I KOSMONAVTIKA is the Air Force's principal publication. For this reason the Commander in Chief's administrative organization is far from indifferent to the degree of attention and popularity enjoyed by this collective propagandist and organizer and to how it promotes accomplishment of the tasks of improving the combat and political training of military aviators.

There was a time when this magazine was a desktop companion, so to speak, for pilots, navigators, engineers, and technicians. We feel that the magazine earned the readers' respect by the fact that it contained topical and relevant materials dealing with the interests of flight personnel, engineers and technicians. The articles, reader response articles, and even the news-coverage type articles were of a clearly-marked practical thrust. Matters pertaining to aerodynamics, tactics, aircraft operation and maintenance, which for various reasons had been ignored in the textbooks and manuals, were examined in detail.

Let us be frank. During the period of so-called stagnation, especially from the end of the 1970s, the magazine began to slip. Articles were not as up-to-date. Keen problem-addressing materials on combat training, flight safety, aviation engineering support, and party political work were crowded out by dull, declarative, repetitive articles of a general political directional thrust, which created the illusion that everything was just fine in the Air Force. The discrepancy between the printed word and the actual state of affairs naturally could not help but affect the attitude of the aviation reader toward this magazine.

Assessing the magazine from today's vantage point, we must state quite frankly that restructuring of the activities of the newspaper staff is progressing rather slowly. Up until recently the staff was clearly failing to keep pace with those processes which were taking place in our country's societal affairs and in the Air Force. Take, for example, USSR and union republic elections of people's deputies. The important election campaigns were marked by great intensity and passion! And yet everything was calm on the pages of AVIATSIYA I KOSMONAVTIKA. Not one military aviator deputy has spoken in this magazine to date, nor have journalists discussed the activities of military aviator deputies. And yet these activities are quite varied. For this reason military aviation personnel should be informed in detail on the positions taken by their representatives in the national parliament and in those of the republics.

The present period is characterized by a substantial growth in the politicization of society. New "informal" [unofficial] organizations, movements, and People's Fronts are appearing practically every day. Their aspirations differ radically. The sociopolitical palette is quite diversified: from far extremism and anarchism to arch conservatism. Unfortunately this magazine has not taken it upon itself to help military aviation personnel gain an understanding of who stands for what.

Or take the following important element. We have recently been living and working virtually in conditions of a multiparty system. This places totally new demands on the organization and conduct of party-political and ideological work. Nevertheless articles on this topic are a great rarity. The activities of party committees and party bureaus have essentially remained beyond the magazine's purview. And this at a time when the CPSU is being subjected to constant attacks by certain forces which are seeking to ascend to power. Such political infantilism on the part of this magazine is intolerable in our opinion. What is needed is a constructive discussion of restructuring of the activities of political agencies for the sake of man's interests.

The people in the Air Force Political Directorate and in the political sections of the combined units and large strategic formations should share with the journalists the blame for failure promptly and fully to inform the readers about steps being undertaken in this area. Not only do their articles appear infrequently, but in addition they are as a rule written in such a formalistic and primitive language and style that they evoke no interest on the part of Air Force personnel. Also meriting reproach are the activities of editorial board member Maj Gen Avn A. Sidorov, first deputy chief of the Air Force Political Directorate, who has not sufficiently energetically enlisted political workers to write articles for this magazine.

Today, when the main emphasis in the work efforts of Air Force units is being placed on qualitative parameters, it is important comprehensively to cover personnel training. Materials of this type have been and continue to be published on a regular basis. We feel, however, that they do not entirely satisfy Air Force personnel, since they run to two extremes: they are either excessively academic and too complex to understand, or they are too superficial. In both cases they have aroused little interest.

Evidently one of the main reasons for this is the fact that the combat training directorate, which is also headed by a member of the editorial board, Col Gen Avn A. Borsuk, is not utilizing the magazine's considerable possibilities of influencing the process of perestroyka and optimization of military training in line units. And yet it is possible with publicity and with much greater effectiveness to resolve problems of training with the assistance of AVIATSIYA I KOSMONAVTIKA than by constantly bombarding the regiments, combined units, and large strategic formations with great numbers of coded messages, which simply lie around headquarters, since the commanders sometimes do not even take a look at them. We hope that the people in this directorate will draw appropriate conclusions from what we have stated above.

On the other hand the commander in chief's administrative organization would very much like Air Force personnel in the line units to make use of the pages of this magazine for their own suggestions and practical articles. Up to the present time we note no initiative from the lower echelons. There are evidently several reasons for this: some people are not convinced that their words will be heard by the command authorities, while others simply fear unpleasant consequences for frankness and criticism. In this connection we hereby declare and assure the readers: first, any constructive suggestion will definitely be considered by the appropriate Air Force Main Staff directorates and services; second, most serious steps will be taken against instances of persecution of authors for criticism and for expressing truthful opinions and points of view about the state and condition of the training system. The individual under attack must immediately notify the editors, and support is guaranteed.

AVIATSIYA I KOSMONAVTIKA is a forum which is freely available to every pilot, navigator, engineer, technician, and supporting unit specialist personnel. This approach will help achieve genuinely strong ties between military aviation personnel and the Air Force Main Staff. And this is extremely important today, for one must understand the fact that a full-fledged military reform is essentially impossible without specific, well-thought-out and precisely-reasoned suggestions and proposals from the lower echelons. The experience of past years attests to the fact that if the process of reform proceeds only downward, in an administratively rigid fashion, in the final analysis we shall once again fail to achieve the anticipated results. The synthesized opinion of the military aviation community is needed in order to prevent this from happening. We are therefore placing high hopes on support and activeness on the part of Air Force personnel. The editors await your suggestions.

A good deal of deserved adverse criticism is directed toward the magazine by engineers, technicians, and rear services and communications specialist personnel. An analysis of articles appearing in past years indicated that the problems of these military aviation personnel have been of little concern to the magazine staff. Aviation engineering topics have been represented on the pages of this magazine in a very meager, pale, and rather toneless fashion. One is also perplexed by the cool attitude toward these magazine shortcomings by editorial board member Col Gen Avn V. Shishkin. Probably greater firmness should be used in evaluating the quality, instructiveness and relevancy of the materials submitted for an issue. It can hardly be considered a normal situation that for several years in a row now AVIATSIYA I KOSMONAVTIKA has contained no articles by regimental and squadron engineers, separate airfield technical support battalion commanders, commanders of signal battalions, chiefs of flight aircraft maintenance unit servicing and maintenance groups, and area-specialization technicians.

Without question this magazine should more extensively address problems of flight safety. Reducing the number of air mishaps is a task of paramount importance. In our opinion emphasis should be placed on materials which reveal the essence of preventive efforts. There have been few such materials to date. It is high time to commence a discussion and debate on the contents of the Air Mishap Prevention Plan. In the line units they have only a very vague notion of this plan. As we see it, the editors, together with the USSR Ministry of Defense Aviation Flight Safety Service, which is headed by Col Gen Avn Ye. Rusanov, should ensure that every issue contains articles which analyze the causes of specific mishaps, fatal accidents, and dangerous near-mishaps and provide practical recommendations by specialists on preventing such incidents in the future.

We should also like to bring up the following important item. Air Force officials are currently engaged in restructuring the present training system and with creating a situation and atmosphere in the course of this restructuring process whereby flight personnel would be able openly, without threat of punishment, to report mistakes and psychological difficulties which have occurred during flight operations, would be able to share their own doubts and misgivings, and would be able to obtain advice and counsel from qualified persons. We are well aware that, after long years of a principle holding sway whereby the main thing was to find the guilty parties, not to get to the actual causes of air mishaps, when the majority of conclusions boiled down to accusing pilots of lack of discipline, there will be few persons willing frankly and openly to share their thoughts with their superiors.

It will take time in order radically to alter the existing situation. But we simply do not have time at our disposal. Therefore, giving full support to the idea of establishing a confidence service [sluzhba doveriya] attached to this magazine, we appeal to all military aviators to cross the barrier of distrust and to report openly and frankly (even anonymously) those difficulties of a professional and psychological nature which you encounter during flight operations. Bear in mind that only with such frankness and openness can we obtain

useful advice and ensure against possible problems aloft, as well as helping one's comrades avoid similar situations.

We cannot help but be concerned by the fact that such commanders as Maj Gens Avn S. Oskanov and A. Pavlenko and Cols V. Dovalgo, I. Frolov, and V. Tsalko make little use of AVIATSIYA I KOSMONAVTIKA in their activities. The collectives they lead perform complex, critical tasks, are at the leading edge of military aviation science, and are continuously engaged in certification and adoption of the recommendations of military aviation science into practical combat training. Therefore, why not disseminate advanced know-how, and why not publicize progressive forms and methods of training flight personnel, engineers and technicians with the assistance of this magazine? We feel that such a lack of initiative is simply intolerable. We hope that the individuals mentioned above will radically revise their attitude toward this magazine.

A period of radical transformations (and we are presently entering precisely such a period) has its positive and negative aspects. It is dangerous primarily in the fact that the old underpinnings of our professional work activities may collapse much faster than a new system is established. Since we bear responsibility for this nation's security, we cannot allow this to happen. Therefore rapid-response criticism of shortcomings and deficiencies as well as rapid dissemination and intelligent adoption of advanced know-how are taking on particular importance.

In connection with this we recommend that volunteer military correspondent posts be established in every unit, these posts to be headed by the most respected individuals in the unit, superior thinkers and persons of integrity. The job of these volunteer correspondents would be to prepare for the magazine on a regular basis materials dealing both with successes as well as shortcomings and deficiencies in military activities. And in order that the process of propagation of glasnost develop on a democratic basis, it is desirable to assign direction of the activities of volunteer military correspondent posts to the Assemblies of Officers, while continuing to have commanders and political workers responsible for ensuring an active work effort.

Since we are talking about the magazine becoming a genuine assistant to the command authorities in improving the Air Force and a bearer of vanguard military aviation thinking, we must also address the question of Air Force personnel utilizing in their daily work activities that information which the magazine contains. In the future, at end-of-training-period performance evaluations and when taking graded tests for proficiency rating and confirmation of rating, it would make sense for certification board members to conduct discussions on the most current and relevant materials published in AVIATSIYA I KOSMONAVTIKA. Working with periodicals is an important indicator of professional improvement. As for subscribing to this Air Force magazine, in our opinion it is simply a matter of honor for each and every airman, because this magazine is about them and for them.

The magazine's staff is presently undergoing considerable renewal of personnel, with the infusion of new faces. One can only welcome the course of policy being taken by the magazine to accomplish a fundamental change in its countenance and content. The results of these efforts are already apparent. Many problems still remain to be resolved, however. It is our view that editorial board members comrades P. Belonozhko, A. Borsuk, S. Bugrov, A. Goryainov, Ye. Rusanov, A. Sidorov, G. Titov, V. Shatalov, and V. Shishkin, who hold high positions and possess corresponding capabilities, certainly are capable of giving specific assistance to the magazine staff in organizing its activities, in providing the staff with modern technical resources, and creating normal working conditions. The only magazine in the country servicing such a specific and costly branch of the Armed Forces should not be in the position of a poor relation. Let us be self-critical: that is precisely the way things are right now.

We are also hoping for help from the Main Political Directorate of the Soviet Army and Navy. In view of the specific nature of aviation, we must resolve the problem of shortening the time required to put magazine issues through the publication process, in order that the materials contained in each issue can promptly influence those processes which are taking place in the Air Force. This particularly applies to preventing aircraft accidents. But this cannot be done without handling the publishing process with modern printing facilities. And if we acknowledge that improving flight safety is a matter of national importance, then our approach to solving this problem should be national in scope.

...In conditions of restructuring the combat training activities of Air Force units, all of us would like salutary changes to occur as rapidly as possible, producing more tangible results. But how can this be accomplished? Most probably those for whom the Air Force's future is not a matter of indifference have suggestions to make on the reform which is being implemented. But is every individual prepared to make specific suggestions, which will lead to the stated goals by the shortest path? The pages of this magazine are open for debate and discussion! Let us by joint efforts do everything to ensure that each new issue of AVIATSIYA I KOSMONAVTIKA propels us further and further from the past and brings us closer to the desired goal, as if cutting in the afterburners.

Editor's Column

90SV0038B Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 90 (signed to press 29 Apr 90) p 5

[Message to the readers by Col V. Anuchin, editor in chief of AVIATSIYA I KOSMONAVTIKA: "Editor's Column"]

[Text] Dear Readers! AVIATSIYA I KOSMONAVTIKA is presently experiencing a turning point. The editorial

staff is faced with an important, difficult task: how to restructure our work in such a manner that the magazine becomes a friend, adviser and defender for those who serve in the Air Force and for those with an interest in aviation.

We are fully aware of the fact that AVIATSIYA I KOSMONAVTIKA as it was in 1988 and 1989 was far from fully satisfying the interests of the aviation professionals among its subscribers. The time has come to make a change in direction. What the magazine is to become depends in large measure on you, valued readers, on your suggestions and recommendations. We therefore urge you to take a few minutes and present your view: what would you like to see this magazine become?

We feel that in the present situation we must conduct a detailed discussion of radical restructuring of the system of training used by Air Force units and subunits, since in our opinion the old approaches to its organization have not only totally outlived their usefulness but have even become an impediment on the road toward the heights of military expertise. The staff awaits constructive suggestions from pilots and navigators, engineers and technicians, scientists and teachers, rear services and communications specialist personnel.

A no less critical item on the agenda is problems pertaining to ensuring flight safety. The existing principle of finding the guilty parties rather than the causes of air mishaps not only fails to help reduce the accident rate but, on the contrary, further aggravates the situation with falsifications, lies, and insincerity, which attend accident investigation. In connection with this, this magazine intends to wage a determined campaign to gain legal recognition of a pilot's right to make a mistake, and to scrap the archaic stereotype used in evaluating the quality of flying performance. As things stand at present, however, a pilot is already culpable by virtue of the fact that he has taken the controls of a fixed-wing or rotary-wing aircraft!

As we see it, this magazine should carry an extensive discussion and debate on how the work of political agencies and party organizations can be restructured in a beneficial manner. What functions should they perform? What structure should they have? Many questions have accumulated, but at present few sensible answers are being received from the political workers.

We feel that one of our principal obligations is to wage an uncompromising campaign to increase the social and legal protection of aviation personnel against despotism by their superiors, against disorganization, unwarranted restrictions and unnecessary simplifications in combat training, etc.

In responding to reader requests, AVIATSIYA I KOSMONAVTIKA will discuss on a regular basis little-known pages from the history of Soviet and foreign aviation: combat operations on the Khalkhin-Gol River, in the Soviet-Finnish War, in Korea, etc. Materials being readied for publication deal with various types of aircraft, including those which for various reasons never entered regular production. Information on modern foreign aircraft. This magazine will be a one-of-a-kind source of information on the space program, on unidentified flying objects, and on puzzling phenomena.

We need your support today, esteemed readers, more than ever before: your advice, active cooperation, constructive criticism and, particularly, your subscription, for this magazine has practically no newsstand distribution. While counting on your understanding, we in turn pledge to help you in every way possible and to live up to your expectations. Our strength lies in solidarity and mutual assistance.

Birth of a Tactical Move

90SV0038C Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 90 (signed to press 29 Apr 90) pp 6-7, 24-25

[Article, published under the heading "Into the Combat Pilot's Arsenal," by Col V. Gryaznykh, candidate of military sciences, and Lt Col A. Golovin: "Birth of a Tactical Move"]

[Text] **Candidate of Military Sciences Col V. Gryaznykh and Lt Col A. Golovin discuss innovation in tactics and the logic of modeling of combat maneuvering.**

There have developed to date two concepts of tactical move, which seem different but which essentially supplement one another. The first incorporates a synthesized procedure of action in standard conditions, with a specific named maneuver, such as virazh [banked turn; 360-degree banked turn; evasive oblique weaves], zmeyka [S-turn(s)], kobra [tailslide; past-vertical pitch-up maneuver and tailslide], etc. It defines the type of tactical move on the basis of combination of the most general principles of the tactical environment. The second comprises actions by a pilot (aircraft commander, element leader), precise in place, time, and intensity, aimed at sudden, with the element of surprise, and complete utilization of the aircraft's combat capabilities and external conditions for the purpose of successful accomplishment of the assigned mission and prevention of casualties and aircraft losses by means of sequential utilization of the acceptable elements of a tactical move and their required parameters.

Pilot selection of reasonable tactical moves in the swiftly-changing situation of a combat mission is accomplished as a rule utilizing the situation management [situatsionnoye upravleniye] method. It presumes response to a specific tactical situation in the form of a ready decision or solution, with subsequent adjustment or correction in the course of maneuver execution. The

larger the selection of standard situations and corresponding decisions a pilot (commander) has mastered, the higher his level of tactical proficiency and the greater his capabilities to respond in the air in an innovative manner.

The process of development of a "bank" of various situations and a corresponding "package" of tactical moves, the decision to utilize which is made in the air during a combat mission, presupposes the following: a detailed and thorough study of the adversary, his strong and weak points; systems analysis of the tactical environment and external conditions applicable to the principal tasks to be accomplished; forming of standard tactical situations—air defense modules—and their classification by level of complexity and influence of various factors; elaboration of a simulation model of surmounting hostile air defense countermeasures; forming of variations of pilot actions for specific standard situations and selection of type according to criterion of effectiveness; selection of reasonable and rational tactical moves in standard situations.

Analysis of the tactical situation is performed on the basis of hierarchical air defense modules, which contain at the first level specific air defense assets (SAM missile systems, self-propelled AAA), deployed in the mission area, after which they are consolidated into subunits and units of homogeneous and mixed composition, defending corresponding troops and installations. A detailed operational model is developed for each first-level air defense asset; at subsequent levels this model is incorporated into a synthesized air defense model as a finished module and can be additionally modified on receipt of additional tactical information. Matters pertaining to coordination, command and control of air defense forces and assets are refined and detailed in the course of these sequential actions.

Fifteen first-level modules have already been developed and are being used in the instructional process at the Air Force Academy imeni Yu. A. Gagarin. These modules encompass practically all the tactical air defense weapons of the NATO member countries, as well as modules which integrate them into local air defense.

The forming of optimal variations of actions aimed at penetrating air defense in a standard tactical environment is the most complex and critical phase. Flight personnel should take part in this process, when air units have available tactical training simulators, computers, and high-quality "games" software. This will provide free rein to innovation in combination with working out and rehearsing reasonable and efficient tactical moves on the ground and during training sorties.

There is a logical diagram on pages 24 and 25 [see following diagram] which can be used for amassing a "bank" of tactical situations and a "package" of reasonable tactical moves, and for preparing for a combat sortie. The first branch in the diagram is connected with the possibility of selection and utilization, for successful air defense penetration, of the parameters of the air (cloud cover, visibility, position of the sun, etc) and ground (topography, tracts of forest, etc) environment.

Each of these parameters in turn can be examined in greater detail, depending on the pilot's experience and the possibility of taking into account their influence on the effectiveness of the developed tactical move. For example, flying above a forest expanse at least 7-10 km wide at a height of 70-100 meters practically eliminates the possibility of taking fire from short-range antiaircraft weapon systems due to limitations in detection and target tracking capability as a consequence of high shadowing angles.

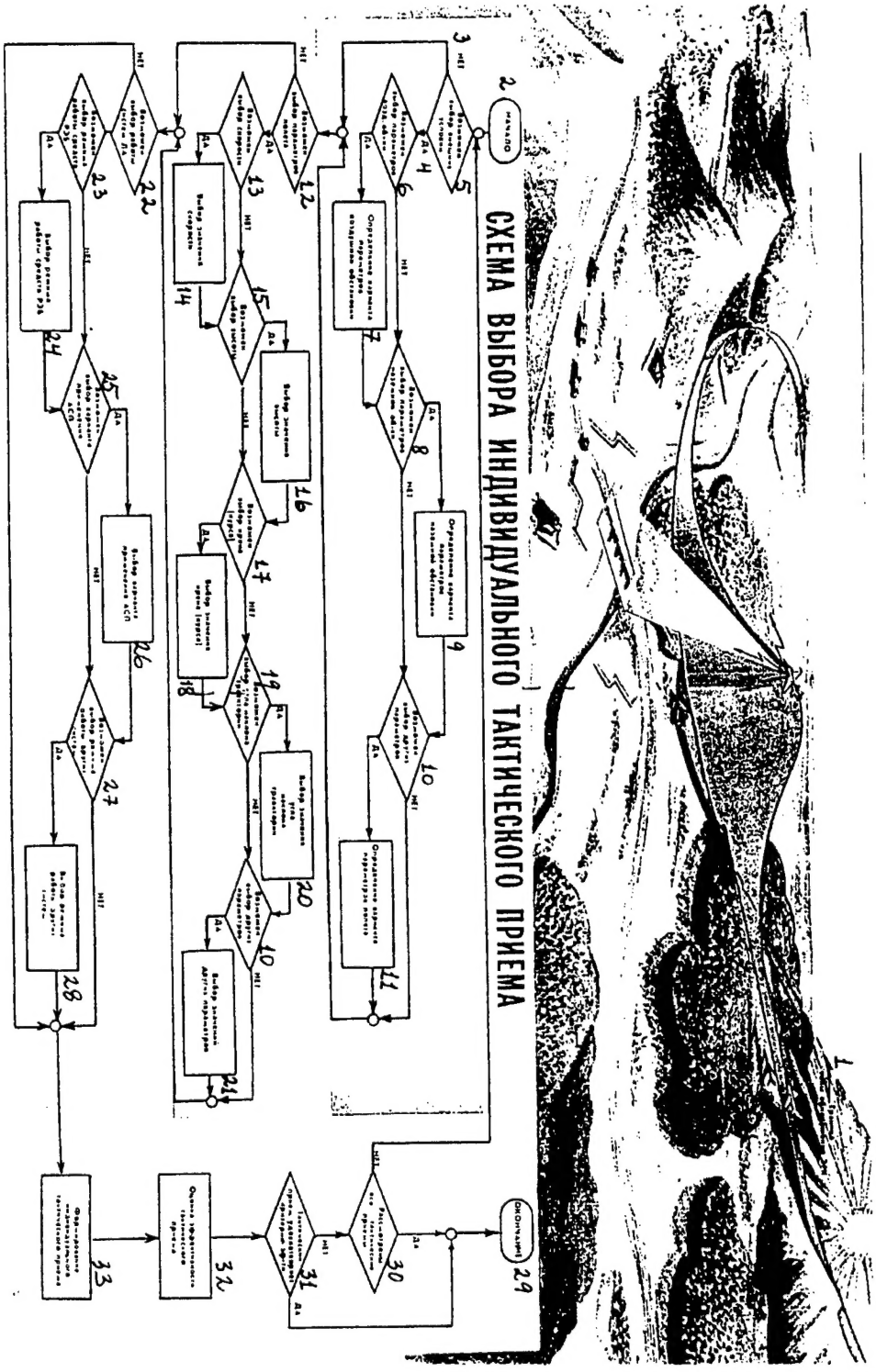
The second branch of the logical diagram is more specific and detailed. It describes such parameters of aircraft motion as speed, altitude, heading, roll and pitch angles. By assigning values to these parameters, one can plot the aircraft's required flight path for any tactical move. When necessary, this part of the diagram can also be supplemented horizontally.

The third branch determines the values of parameters which characterize operation of an aircraft's systems: EW gear, and employment of the aircraft's weapons. Just as in the two other branches, there is a provision for building this branch up in order to take into account (if necessary) the influence of the parameters of other systems, such as engine power settings.

The diagram is constructed in such a manner that it is open and can be developed horizontally—with further detailing of the specified factors, and vertically—when new groups of factors are included. A tactical move is the output. A question arises, however: how can one assess the correctness of the selected parameters, and what will be the effectiveness of air defense penetration?

Answers can be obtained to these questions only after conducting full-scale testing or an experiment utilizing a mathematical simulation model specifically developed for the purpose of assessing the effectiveness of tactical moves taking into account the restrictions and limitations of system operation. For example, SAM systems with a semiactive Doppler radar guidance system have a limitation connected with the existence of "blind target angles." This limitation is exploited when executing a missile-evasion maneuver and the corresponding tactical move "break from SAM position by an angle assuring target illuminating radar automatic tracking lock break."

Diagram of Selection of Individual Tactical Move



Key:
1. Boundary of surface-to-air missile detection coverage zone
2. Start
3. No
4. Yes
5. Selection of external conditions possible
6. Selection of air environment parameters possible
7. Determination of variation of air environment parameters
8. Selection of parameters of ground environment possible
9. Determination of variation of ground environment parameters
10. Selection of other parameters possible
11. Determination of variation of flight parameters
12. Selection of flight parameters possible
13. Selection of speed possible
14. Selection of speed value
15. Selection of altitude possible
16. Selection of altitude value
17. Selection of bank angle (heading) possible
18. Selection of bank angle (heading) value
19. Selection of flight path angle possible
20. Selection of flight path angle value
21. Selection of values of other parameters
22. Selection of aircraft systems operation possible
23. Selection of EW equipment operating mode possible
24. Selection of EW equipment operating mode
25. Selection of variation of aircraft ordnance employment possible
26. Selection of variation of aircraft ordnance employment
27. Selection of operating mode for other systems possible
28. Selection of operating mode for other systems
29. End
30. All tactical moves have been considered
31. Tactical move meets effectiveness criterion
32. Evaluation of effectiveness of tactical move
33. Forming of individual tactical move

Effectiveness depends on the selected parameters: breakoff angle, speed during turn, and distance from SAM position or missile at moment of maneuver initiation. Their combination should ensure the following condition: duration of maneuver execution, increased by the automatic tracking system prolongation time, may not exceed SAM missile flight time to the point of impact with the aircraft. In this case the relationship between the selected maneuver parameters and limiting condition for a situation whereby maneuver is initiated at the moment the surface-to-air missile is fired, is as follows:

$$T_{зур} > t_{ман} + t_{п};$$

$$t_{ман} = \frac{V}{g \operatorname{tg} \gamma} \cdot (\Psi_{к} - \Psi_{н}),$$

where $\Psi_{н}$ and $\Psi_{к}$
где

—relative bearings of SAM position to the maneuvering aircraft at the moment of initiation of maneuver and upon aircraft entry into the "blind zone."

Missile flight time to the computed point of impact can be determined in each specific instance on the basis of the surface-to-air missile's known propulsion and ballistic characteristics and simple geometric plots.

The problem is considered solved if the formulated tactical move makes it possible to penetrate air defense and carry out the mission with a specified degree of probability. Otherwise one must return to the diagram start point and do the calculations from the beginning, on the basis of refined parameters.

Let us examine the procedure of formulating a tactical move enabling a single reconnaissance aircraft successfully to penetrate past a short-range SAM system with a radar guidance system (see diagram). The aircraft's crew has been assigned the mission of flying reconnaissance of a crossing site during daylight. Any route and direction of approach may be selected.

Such freedom of actions enables the trainees independently to select external conditions which maximally diminish the operating effectiveness of antiaircraft weapons. For example, they can consider the position of the sun in order to cause the system operator difficulties in visual target tracking and to force him to track by radar. A radar channel is less effective than an optical channel and can be suppressed with electronic warfare gear. A forest tract which is located in the immediate

vicinity of the crossing site and which significantly reduces detection range can help in carrying out the mission.

The next phase is determination of the values of the parameters of aircraft movement in the reconnaissance target area which reduce the possibility that the aircraft will be destroyed. This is easily done with the help of mathematical relations characterizing the influence of these parameters on the effectiveness of getting past the surface-to-air missile defenses. This approach, however, makes it possible to obtain only general conclusions on choosing tactics. Recommendations on execution of a complex air maneuver with vertical and horizontal components can be obtained only by using a set of computer-executed mathematical models.

In the concluding phase of formulating tactics, one considers the possibilities of utilizing electronic warfare gear, employing aircraft weapons, engine power settings, etc. The aircraft crew will be able to make a final decision only following detailed analysis and performance of requisite calculations using special methods.

Thus after sequentially running through the three branches of the diagram and determining all parameter values, we obtain a tactical move for a reconnaissance aircraft successfully to penetrate local air defense. But one must also evaluate the solution, which can be done with a computer-executed mathematical model. Selection is made considerably more complicated if it is necessary, for example, not only to conduct reconnaissance of but also to photograph the crossing site. In this case it is necessary to formulate a tactical move which represents an optimal variation of execution of these two missions.

Is There a "Golden Mean"?

90SV0038D Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 90 (signed to press 29 Apr 90) pp 8-9

[Article, published under the heading "Combat Effectiveness and Flight Safety," by Col (Ret) N. Lysenko, doctor of technical sciences: "Is There a 'Golden Mean'?"]

[Text] Successful accomplishment of a combat mission depends in large measure on selection of flight configuration. One must consider a large number of factors, determining among which are combat effectiveness and flight safety. A difficulty, however, lies in the fact that they place conflicting demands on selection of flight parameters. Which of them should be given precedence, and to what degree? The answer to this question is not the same for both peacetime and wartime. But a scientific approach to solving the problem makes it possible to find a "golden mean." We shall examine a possible method of determining it as applied to regular-production combat aircraft and average level of flight personnel proficiency.

Level of flight safety is determined by special indicators, one of which can be the probability of completing a flight without an air mishap or in-flight emergency (P_{bn}). Effectiveness of aircrew accomplishment of an operational mission is estimated by probability P_{b3}. The mission is considered accomplished when an air or ground target is destroyed, reconnaissance has been conducted, an air assault force has been delivered to the designated area, etc, and the flight has been concluded without mishap. If probability of accomplishing the flight assignment (P_{p3}) is adopted as criterion of effectiveness, then $P_{p3}=P_{bn} \times P_{b3}$.

The values of probabilities P_{bn} and P_{b3} are determined by the properties of the aircraft, employed armament, proficiency of flight personnel, and complexity of the mission. The manner and procedure of calculating them is described in materials on theory of flight safety and combat effectiveness and will not be discussed in this article.

This formula is also valid for wartime, since it essentially makes no difference whether we lose an aircraft as a result of battle damage or air mishap. But in such a case it will be necessary to alter the correlation of probabilities P_{bn} and P_{b3} in one direction or another. The experience of World War II and local conflicts indicates that the life cycle of an aircraft is shortened by a factor of 10-20 during a period of military operations and that it "perishes" with considerable unused service life. A question arises: why not accelerate consumption of service life by operating at higher power settings and pushing other systems to higher output, and by relaxing operating restrictions, thus achieving improved performance and, of course, increased aircraft combat capabilities (P_{b3})? Even a concomitant certain decrease in flight safety will change only to a minor degree the probability of an air mishap during the aircraft's life cycle.

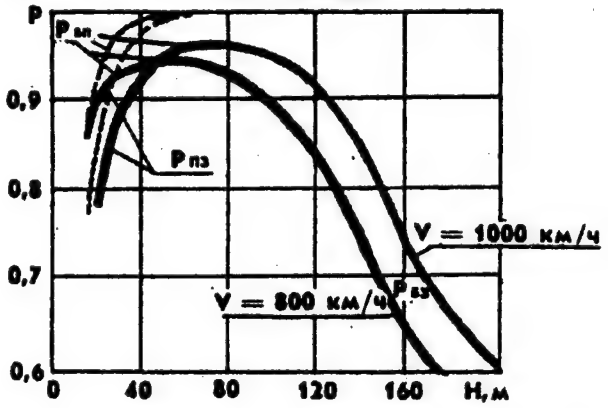
It is another matter altogether in peacetime, when aircraft losses involve only air accidents. In order to prevent accidents, the optimal mission configuration determined on the basis of criterion P_{n3} should be checked to ensure that the level of flight safety is in conformity with the specified requirements. If necessary, corrections will have to be made in combat operating conditions.

1. Selecting a Mission Configuration for Penetrating Hostile Air Defense

Depending on the environment, situation, and assigned mission (delivery of a strike on a ground target with the element of surprise, suppression or neutralization of air defense, etc), requirements on selection of mission configuration vary. In any case one must assure a maximum value to probability P_{n3}. But its components P_{b3} and P_{bn} in turn depend on airspeed and altitude. The lower the altitude and the higher the speed, the smaller the probability that the aircraft will be destroyed, but there is a

greater probability of an air mishap due to the increased danger of colliding with obstacles or the ground. The light solid lines in Figure 1 show the nature of change in probability that an aircraft will not be downed, for two speeds, depending on altitude.

Figure 1. Probability of Successful Penetration of Hostile Air Defense.



The probability that an air mishap will not occur when flying at low level [200-1,000 m] and at very low level [less than 200 m] is determined primarily by accuracy of maintaining mission configuration, which depends on many factors: type and state of terrain surface, airspeed and time, the aircraft's stability and controllability characteristics, the pilot's visual flying skill, his psychophysiological state, etc. A pilot can fairly precisely maintain altitude in level flight down to a height of 100-150 meters (for various types of aircraft). Quality of piloting does not improve below this level, and flight safety drops off sharply.

The dashed lines in Figure 1 represent change in probability that an aircraft will not collide with obstacles, calculated in relation to accuracy of piloting at various altitudes and airspeeds, while the heavy solid lines indicate probability of penetration of hostile air defense equal to the product of $P_{b3} \times P_{bn}$. It is apparent from the diagram that for each airspeed there is a comparatively narrow range of altitudes at which probability of accomplishing the assigned mission is maximum. They can be recommended as optimal for combat conditions.

2. Selecting a Ground Target Strike Configuration

A fighter-bomber crew has spotted a ground target and is attacking it. The main thing is to destroy the target with maximum probability P_{b3} and not to lose one's aircraft by colliding with obstacles, by being struck with fragments from one's own munitions, or by exceeding maximum angle of attack (G load) during breakaway. If the target is defended by air defense assets, it is essential to set up one's maneuver taking air defense response into account.

Since maneuver characteristics depend on the conditions of execution of the strike, we shall first evaluate reasonable strike configurations which offer the highest probability of mission accomplishment. For this we must establish the relationship between the probability of destruction of the ground target (P_{b3}) and the probability of safe execution of maneuver (P_{bn}) on the one hand and the flight configuration at the end of the attack run.

The probability of destruction of the ground target P_{b3} when attacking with rockets is determined by flight path angle Theta, range of fire D (altitude or height H), and speed V. In Figure 2 the dashed line shows the typical relationship between probability of destroying a ground target with unguided rockets on the one hand and angle Theta and height at end of rocket release on the other. It is evident that with an increase in this angle and decrease in height (range) of fire, target kill probability (P_{b3}) increases. It is necessary to increase the angle of attack and G load thereby, however, in order to prevent the aircraft from colliding with obstacles on the ground surface or from being struck by fragments from the aircraft's fired ordnance, which decreases probability P_{bn} (see Figure 2) of safe execution of the attack breakaway maneuver.

Figure 2. Probability of Target Kill and Safe Breakaway.

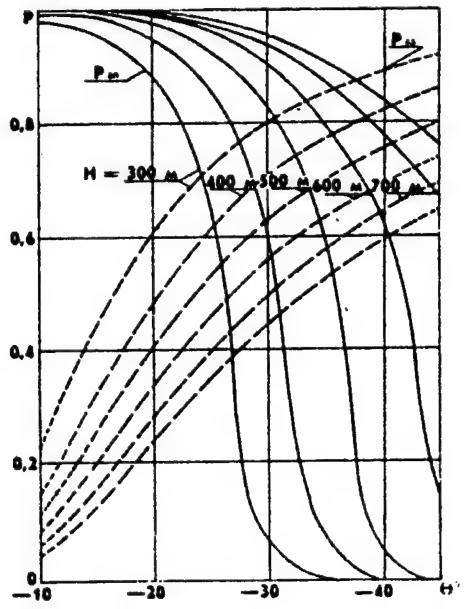
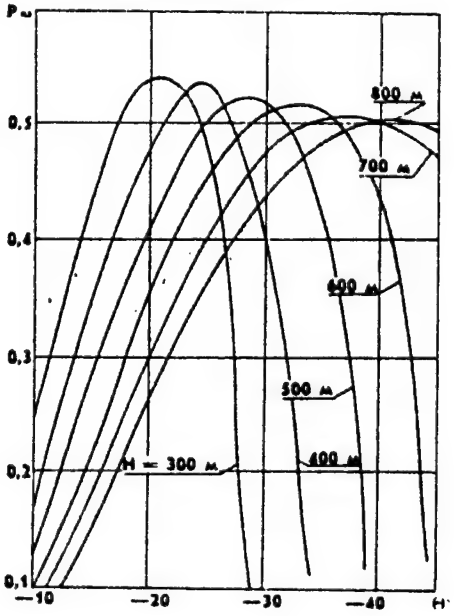


Figure 3 shows a mission accomplishment probability relation (P_{n3}) corresponding to the data used in Figure 2. It is apparent that a quite specific (optimal) flight path angle at which mission accomplishment probability is maximum corresponds to each height of termination of fire on a ground target. With a decrease in angle, P_{n3} decreases due to a rapid dropoff in probability of hitting the target (P_{b3}), while with an increase in Theta, it decreases due to a drop in probability of safe execution

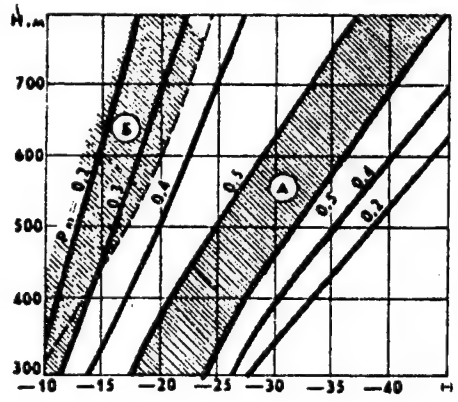
of attack run breakoff maneuver (P_{bn}). The optimal flight path angle increases and mission accomplishment probability decreases somewhat with an increase in altitude of termination of fire on a ground target.

Figure 3. Probability of Mission Accomplishment When Striking a Ground Target.



We shall replot the curves in Figure 3 in order to obtain a more graphic idea of the obtained results. We shall plot lines depicting constant values of probabilities P_{n3} in coordinates H and Theta (see Figure 4). Region A corresponds to the highest probability of mission accomplishment. Values P_{n3} decrease to the right and left of this region. Configurations corresponding to region A can be recommended for wartime combat flying. One should refrain from them in peacetime, however, due to the comparatively low probability of safe execution of the attack breakaway maneuver.

Figure 4. Selection of Optimal Maneuver Parameters in Peacetime and in Combat Conditions.



If we designate with a dashed line those ground target strike configurations with which the minimum allowable level of safe execution of attack run breakaway maneuver is assured, high safety region B, which is located above this line, can be recommended for peacetime. Selection of weapons delivery configurations should take into consideration the need to maintain a flight personnel training method suited for peacetime and wartime, that is, ensuring a rapid and comparatively simple transition from training to combat conditions. From this standpoint, for the data incorporated in Figure 4, when striking a ground target one can recommend for both wartime and peacetime flight path angles of -20°, firing termination heights of 300-400 meters in the first instance, and 600-700 meters in the second.

3. Substantiation of Designating Flight Parameters Operating Restrictions

Comprehensive consideration of aspects of combat effectiveness and flight safety is particularly essential when designating aircraft operating restrictions. Let us examine this as applied to angle of attack.

Figure 5 contains a typical relationship between probability of safe maneuver execution (P_{bn}) and angle of attack. As angle of attack increases, within a certain range P_{bn} remains practically constant and close to 1. Subsequently it begins to drop off, slowly at first, and rapidly as we approach a critical angle of attack. Also shown in the diagram is the relationship between probability of mission accomplishment (P_{b3}) and that same parameter. The higher its value is, the greater the G forces and the better the maneuverability characteristics will be, and correspondingly there will be greater possibility of accomplishing the combat mission. In this instance an opposite-direction change in probabilities P_{bn} and P_{b3} is a "bone of contention" when designating operating restrictions: setting the maximum allowable angle of attack too low makes it impossible fully to utilize the aircraft's maneuver capabilities, while setting it too high drops the level of flight safety even when flight safety-supporting devices are installed.

Figure 5. Relationship Between Probability of Safe Maneuver Execution and Angle of Attack.

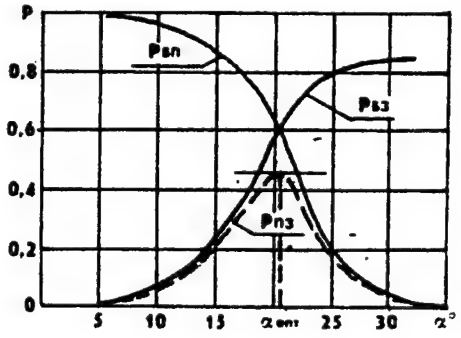


Figure 5 shows change in the probability of mission accomplishment (P_{n3}) calculated in like manner to the

preceding cases. An optimal angle of attack value, which in wartime can be adopted as its maximum allowable value, corresponds to the probability maximum. At such an angle of attack, however, the level of flight safety as a rule proves to be below that required for peacetime. This makes it necessary, in order to ensure flight safety, to reduce the maximum allowable angle of attack, in spite of a decrease in aircraft maneuver capabilities.

The cited examples make it possible to consider in a more well-reasoned manner the principle "Teach the troops that which is essential in war," on which training of flight personnel is grounded. Some commanders interpret this principle erroneously and apply it absolutely literally. This results in totally unwarranted air mishaps. A scientific approach to resolving this problem presumes structuring a flight personnel training method which enables one to maintain a specified level of flight safety and to exercise without difficulties in combat conditions the flying skills which were acquired in peacetime.

It might seem that the proposed methods could be utilized only by Air Force scientific research organizations. The availability of computers and the necessary software, however, will enable all flight personnel to perform this task.

The Years Incline One Toward Harsh Prose

90SV0038E Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 90 (signed to press 29 Apr 90) pp 10-11

[Article, published under the heading "Following a Policy of Perestroyka," by Military Pilot-Expert Marksman Col I. Artyushenkov: "The Years Incline One Toward Harsh Prose"]

[Text] **In determining a retirement age for its citizens, the state obligates itself to guarantee, by working and rest conditions, that they will be capable of working up to that designated age. To violate this condition means to trample social justice. Military pilots are also citizens of their country. Is the state fulfilling its obligations toward them? Military Pilot-Expert Marksman Col I. Artyushenkov states his opinion on this question.**

What does length of a military pilot's flying duty mean? Doctors say that this is a purely medical indicator, which reflects the level of health of flight personnel. Judging by all indications, such a simplified view of the matter is to the liking of the Air Force brass. But are things in fact as simple as it might seem at first glance? By no means. It seems to me that the matter is not only, and perhaps not even so much connected with the health of military aviators as....

Length of flying career of a military pilot is in many respects not a medical category but rather an economic, social, legal, and ethical category, for a first-class military pilot costs the country several million rubles. But if one considers how many pilots in this country are permanently grounded ahead of their time, one can easily calculate that cost-ineffective expenditures just within the Air Force run into the billions. I am deeply convinced that these losses are a consequence of an oversimplified approach in the system of Air Force unit flight personnel manpower acquisition. I shall endeavor to demonstrate my point.

According to the figures at my disposal, the average flying career of line-unit pilots is 10 years (let us remember this figure). The counterpart figure is 24 years for pilots in the headquarters command structure of combined units and large strategic formations. What is the reason for such a marked contrast?

The Air Force, as any production organization, has a specific number of flying slots. It also has labor resources at its disposal: new graduates of Air Force schools, who come to the units each year. But how many of them should there be? It would seem that nobody has calculated this number. If we divide the T/O number of flying slots by the number of pilots arriving each year, we shall obtain a number which determines over how many years a total replacement of regimental personnel takes place. The number we arrive at is 10. Is this a coincidence? It is not. Everything is quite logical here. A regiment is not an inflatable balloon. This means that approximately the same number of veteran pilots must leave the regiment as the number of young pilots arriving.

Here we come upon a social problem. If, let us assume, the length of the average flying career were to increase, the discrepancy between the number of lieutenants graduating from service school and the required number of new pilots in the units (it would be smaller) would inevitably lead to young pilot unemployment. From a formal standpoint this is impossible in our country, and therefore all Air Force flight school graduates are given job assignments.

Veteran officers must be removed in order to open up slots for these young pilots. How is this to be done? After all, you cannot promote everybody: there are only so many higher-echelon slots to be filled. You cannot simply put them out on the street. At this point a cruel and essentially absurd but flawlessly-functioning regulator, which has been honed to perfection over the years, kicks in, forcing a mature pilot to bid farewell to the skies. This regulator consists of such mechanisms as social injustice, intolerable living conditions (including for a military aviator's family), total trampling of reasonable labor standards, voluntarism of command decisions, infringement of the civil rights of military personnel, all types of restrictions, limitations, and unnecessary situation simplification in combat training, etc. And these mechanisms function most effectively precisely within the regiment.

Thus under the effect of these mechanisms, in addition to pilots grounded for actual state of health, there appears a category of pilots who voluntarily accept permanent grounding from flight duty. There are other means of applying pressure on those who firmly withstand the "burdens and privations." They are treated

more harshly in all areas: for an air mishap even if they are only indirectly to blame; for current proficiency which has declined inasmuch as they have been prevented from flying; for obstinacy of character, expressed in criticism of the imperfect combat training system, etc. As a result a second category of "former pilots" is formed: pilots who have been grounded for infractions or removed from flight duty.

There is also another, natural regulator: losses of personnel. This regulator is directly linked to the first two: the greater the number of social problems, problems with housing and living conditions, and injustice, the greater the degree of moral pressure on the pilots, the more frequently fatal accidents occur. And it is high time that we officially acknowledge this pattern and mechanism, rather than hypocritically explaining away air mishaps as being caused by nothing but pilot error.

What should be the average length of flying career for a military pilot serving at the regimental level? If we proceed from the principle of social justice, it should be at least 20 years. But if we are guided by requirements on professional readiness and preparedness, it should be perhaps 25. And, finally, it should be 30 years from the standpoint of peacetime economic expediency and the experience of developed countries. When will society and the government finally grasp the following axiom: by not meeting its obligation to guarantee pilot work fitness by providing adequate social conditions for work, rest and recreation, it is costing the state each year billions of public rubles for this failure. There is real meaning in the saying: "the miser pays twice."

Provide normal conditions for the pilot, give him the opportunity freely to improve his skills, and he will fly for 20 years as a major, paying back costs a hundredfold. In addition, he will not be less than a fully-developed pilot, with the ways of a demagogue-amateur, but will be a professional in every respect. But how can this be accomplished with our across-the-board poverty?

I suggest the following. We must establish in the regiments a certain reserve stock (a reserve for increasing length of flying careers) of flying slots, which will perform the function of hysteresis with the present absence of feedback between air units and Air Force schools pertaining to training the required number of young pilots. In my opinion we should put the recruiting of cadets on hold for two or three years and during this time boost the prestige of the flying profession among young people. Subsequently we should recruit half as many young men, but double the selection process requirements for admission to service school.

During this period it would make sense to hold back the graduation of young pilots—potential ballast of line regiments—and boost them to the level of 3rd and perhaps even 2nd class. The money saved should be spent to improve conditions for work and rest. Pay should be doubled or tripled, in a differentiated manner, based on job difficulty and hazard, while pension benefits paid to pilots who have flown for 20 to 25 years should be doubled.

In implementing this reform one must bear in mind the following: first of all it is essential to raise the prestige of flying and increase the social protection of aviation personnel, after that increasing the length of a pilot's flying career and saving billions of rubles, but not in reverse order. If this is done, I am convinced that results will not be long in coming.

The most difficult thing involved is to replace a multistage mechanism, developed over the course of decades, with a new approach to providing flight personnel to air units. Just as a shadow economy cannot exist without a shortage of goods, its primogenitor—the administrative-command system—is unable to function without a shortage of social activeness, conscientiousness, and legality. I shall state frankly that the hierarchic, voluntaristic military system worked hard to ensure that this shortage was present in abundance, if I may state it in these terms. It is easy to control dull, faceless masses lacking in initiative. But it is difficult to gain victory!

Perhaps my arguments are tendentious, one-sided, fundamentally erroneous and even harmful. I am prepared to listen to counterarguments. But if what I have stated is merely brushed aside, then one must observe a depressing fact: Soviet pilots are the world's most sickly! But I do not believe that, if only because, having put in his time in the regiment and obtaining a promotion to a higher-echelon position, a pilot as a rule does not experience health problems. This means that we must work to increase the length of pilots' flying careers not with pills and tablets....

Is There a Way Out of the Impasse?

90SV0038F Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 90 (signed to press 29 Apr 90) p 12

[Article, published under the heading "Combat Training: Viewpoints, Opinions," by Military Pilot 1st Class Lt Col A. Zhukov: "Is There a Way Out of the Impasse?"]

[Text] The fact that the existing combat training system used in air units and subunits represents a dead end, which fails to promote improvement in the combat skills of military aviators, is quite obvious to us in the line units. Is there a way out of this impasse? Let us examine the situation. We shall use several comparisons.

The basic sense of restructuring the economy is a transition to working with a focus on the end result, utilizing objective laws of economic development. In my opinion the same procedure should be following in the military. Of course if we want to achieve an actual high level of

combat readiness, rather than "on paper alone," and want to utilize in full measure the potential of our modern weaponry.

The end result of combat training for air units is their capability to commence operations in any environment and situation in an organized manner, at the designated time, and successfully to accomplish assigned missions. At the present time the presumption is that this is to be achieved by carrying out the flight training and commander training plan and schedule and by conducting one or two regimental and five or six squadron-level tactical air exercises (LTU). The first of these is governed by the Manual of Flight Operations (NPP) and the combat training program (KBP), the second—by the list of subject categories and the time allocated for their study, and the third—by the KBP, and is to be guided by the Manual of Combat Procedures and Regulations (BU).

It would seem that everything is spelled out and quite clear. But the fact is that requirements on combat readiness are not removed from the units, regardless of whether or not tactical air exercises have been conducted. And during inspections by higher echelons, such as the Main Inspectorate of the Ministry of Defense, smoothness of teamwork and coordination by a commander and his staff is graded according to the Manual of Combat Procedures and Regulations. Here is where problems arise.

The process of transition to working according to the Manual of Combat Procedures and Regulations is not precisely defined and has not been properly set up. The impression is created that the higher-ups think that everything begins spontaneously, "on a whistle." In actual fact things are not as simple as the inspecting officers might think. Let us consider the following question: is it mere happenstance that one out of every four air mishaps occurs during inspections of combat readiness and conduct of tactical air exercises? And is it in fact logical to organize the training process according to the requirements of the KBP, but to be performance tested according to the BU? I do not think so.

What must be done to refocus the efforts of the Air Force line unit from quantitative to qualitative indices, to the end result?

To obtain an answer to this question, let us turn to current realities. It is no secret that tactical air training is the principal form of practical pilot training in flying single-aircraft sorties as well as formation flying and procedures in the two-ship formation, flight, squadron, and regiment formation in various ground and air environments, with maximum utilization of the aircraft's capabilities. The tactical air exercise is the correspondingly highest-level form of this training.

The tasks specified in the KBP determine the training flights and maneuver sequences during which tactical air proficiency is developed. Thus the presumption is that flight personnel are at the same time preparing to carry out missions as prescribed by the Manual of Combat Procedures and Regulations. But do the training sorties and maneuver sequences we fly in peacetime in fact ensure high-quality preparation of aircrews to perform the missions specified by the BU? They do not, and here is why.

It is virtually impossible to handle the volume of training work specified by the NPP and at the same time to train pilots in conformity with the requirements of the BU. Every commander knows that there will be severe punishment for failure to meet the requirements of the NPP, while one can frequently get away with a lip-service approach to tactical air training. This is why in our daily activities, in preparing for flight operations, we do not take guidance from the BU. Therefore, no matter what kind of documents demanding improvement in tactical air proficiency are received at the unit level, there will be no appreciable change for the better, for they are viewed "on the line" as nothing more than declarations. It is my profound conviction that a genuine improvement in combat readiness by improving the effectiveness of the military aviator training process is possible only by integrating flight training and commander training tasks on the basis of the Manual of Combat Procedures and Regulations.

I feel that it is high time for us to move away from delimitation of flight training from commander training. They should be done together—based on the missions of the specific air component. Within the scope of these tasks and missions, pilots can both be brought back up to combat status and trained for combat operations, planning and scheduling initially the practicing of simple maneuver sequences, followed, as pilots are ready to advance, by more complex maneuvers, in conformity with the overall concept of operations and general tactical environment.

Instruction in theory should be conducted within the framework of training for combat operations, assessing the environment and situation by elements: the enemy, friendly forces, etc. Conducted experiments (on a limited basis, it is true) have shown that in such cases pilots, estimating the situation and independently working out a solution, gain an understanding of how much one must know in order to handle this task. The very situation compels them to abandon job-related infantilism, and to work to improve themselves. Incidentally, this is fully confirmed by the practical experience of preparing regiments for performance evaluation inspections by the Main Inspectorate of the Ministry of Defense, when commanders stop the chase after gross performance figures and restructure the activities of their units in the manner as proposed in this article. Unfortunately, however, after the inspection is over everything returns to the old way. It is high time to put an end to this shifting back and forth.

Plain Talk About Accidents

90SV0038G Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 90 (signed to press 29 Apr 90) pp 13-16

[Article, published under the heading "Flight Safety: Experience, Analysis, Problems," by Lt Col A. Zhilin, editor for flight safety: "Plain Talk About Accidents"]

[Text] **Fatal air crashes and nonfatal air mishaps are a tragedy of society. Every year the negative moral and ethical content of this tragedy is materialized as the payment of frightful tribute in the form of snuffed-out priceless human lives and immense financial resources smashed into the ground. Up until recently it was forbidden to discuss this openly and, passing over in silence the actual state of affairs, we were like an ostrich sticking its head in the sand. It is becoming increasingly obvious today, however, that we shall be unable to resolve the problem of flight safety solely by the command-administrative method, by administrative manipulation. This is a problem not only of national importance but of interest to all our people. I feel that it is precisely for this reason that it is high time to address the wisdom of collective thinking to this problem, freeing the matter from long years of bondage under the control of ministerial organizations, directorates and services, which are bound by specific narrow and frequently selfish interests as well. Incidentally, this speaks in favor of stepping up the activities of the Aviation Flight Safety Service of the USSR Ministry of Defense, which is tasked with coordinating the performance of this difficult and crucially-important task.**

What Do We Have?

We could take as a kind of intermediate point of departure for commencing an analysis of the state of flight safety the 1965 CPSU Central Committee and USSR Council of Ministers decree entitled "On the Air Accident Rate in the USSR Armed Forces." This document formulates one of the fundamental criteria by which we continue to be guided: "...Total flying hours logged per mishap constitutes a true indicator and objective assessment of the accident rate." Evaluating the state of affairs by this measure, we can glibly report: "From 1965 through 1988 the average flying time logged per air accident rose from 16,000 to 27,000 hours! The number of fatal accidents decreased by a factor of more than three!"

Let us give some sober thought to this, however, rather than yielding to instant euphoria: is the criterion which was proclaimed by the Central Committee and Council of Ministers 25 years ago really so universal? After all, there is a difference between one flight and another. One can fly at the edge of the capabilities of pilot and equipment, as they say, and one can also fly the same routes year in and year out, flying training missions with unnecessary situation simplification. And incidentally, the latter is by no means a rarity with our military aviation. Did this "true indicator" not in time begin to produce metastases all over the combat training organism in the form of all kinds of prohibitions, situation simplifications, restrictions and limitations? If one looks closely at the problem of safety from this point of view, the curtain of relative well-being, as it rises a bit, will disclose serious problems in organization of the operations of the entire aviation mechanism.

Even a simple comparison of the number of nonfatal mishaps and fatal accidents in the Air Force, for example, during the periods 1965-1968 and 1985-1988 attests to the fact that the absolute number of accidents remained approximately the same. For this reason it is as yet premature to claim a radical improvement in the flight safety situation. In addition, in evaluating the air accident situation on the basis of cost of destroyed aircraft, one comes to the discomforting realization that a great deal more of the people's money has been "buried." And this is logical. The "cost" of air accidents has increased considerably in connection with the increase in economic expenditures on building fixed-wing and rotary-wing aircraft. In addition, it has become much more expensive to train flight personnel at Air Force higher educational institutions, and the cost of training pilots in line units has also increased. As a result economic losses caused by air accidents (in comparison with 1965) have increased almost 10-fold! This is what lies hidden behind a one-sided figure.

To gain a deeper understanding of the patterns and mechanisms of change in the air accident rate, we shall utilize a method developed by the Aviation Flight Safety Service (SBP) of the USSR Ministry of Defense. Let us examine first of all how the principal causes of air accidents have changed over a span of time and, secondly, where the most substantial successes have been achieved in preventing air accidents, and where achieved results are more modest. For this purpose we shall place all causes of nonfatal and fatal accidents into three basic groups.

First Group: Through the fault of personnel. These include air mishaps caused by violations of rules and procedures in organization and direction of flight operations, indiscipline and faulty actions by flight personnel in piloting aircraft and in aircraft operating procedures.

Second Group: Equipment failures and malfunctions for various reasons. These include equipment failure through the fault of the manufacturer, engineer and technician personnel of units and aircraft maintenance depots, for undetermined reasons, as well as factors connected with damage to aircraft caused by birdstrikes.

Third Group: Air accidents in which investigation boards were unable to determine the actual cause.

The dynamics of change in these indices attest to the fact that the causes of accidents have undergone an appreciable redistribution over this period of 24 years. Culpability of flight personnel has increased by a factor of more than 1.5.

The number of air mishaps due to equipment malfunction, failure, and disintegration, as well as caused by birdstrikes, decreased by almost half. And, finally, there has been a twofold decrease in the number of air accidents the causes of which have not been established. We should note at this point that these trends are typical not only of our own Air Force but of world aviation as a whole.

The new aircraft which have replaced second-generation and now third-generation aircraft as well are more reliable due to redundancy of vital systems, etc. The majority of modern aircraft are powered by two engines. Intensive efforts are being conducted to implement comprehensive programs to ensure flight safety.

One should not, however, ignore the important fact that the further development of aircraft equipment has led not only to increased reliability. The tasks performed by aviation have become much more complex. The pilot's work has changed significantly. It is now characterized by an almost continuous lack of sufficient time for preparation (especially personal preparation) for flight operations, for training sessions devoted to preventing accidents and improving a pilot's knowledge, and for flying the aircraft. Deficiencies in professional (moral-psychological included) training and preparation of flight personnel, bountifully engendered by simplifications, restrictions and limitations in combat training, and by social problems as well as problems with housing and daily living, have advanced to a leading position among causes of nonfatal and fatal accidents. We can state without exaggeration that they have become the principal causes. Nor is this surprising, for man constitutes the principal control element in the "aircrew-aircraft-environment" system. Nevertheless the least attention is devoted to the human operator by the existing combat training system. Unfortunately concern for military aviators has much more frequently been proclaimed and much less frequently been backed up by specific actions. And what is the result?

Accident statistics objectively indicate that pilots flying single-seat aircraft are less reliable. Apart from all else, the large number of limitations and restrictions (in-flight abnormal or emergency situations, an abundance of procedural instructions on actions to take in such situations) contained in aircraft operation documents, and the flood of various current instructions coming down from the higher echelon have a negative effect on these pilots. An additional factor is the effect of shortcomings and deficiencies in organization of aptitude screening and selection of future military pilots. This process is aggravated by limited possibilities of conducting full-value, from the standpoint of effectiveness, ground training sessions for line-unit pilots (employing effective and efficient modern technical means and devices); by the difficulty of determining and pinpointing mistakes and errors made by aviators in the air; by the meager number of hours pilots are allowed to log; by the sweeping charging of pilots with all serious shortcomings. Thus one negative element is layered on another. And all this has been going on for many years....

We should note that many of these problems were addressed in detail in the above-mentioned 1965 Central Committee and Council of Ministers decree. For example, this document prescribed finding capability to increase by 30-40 percent the normal number of flight hours logged by Air Force Frontal Aviation pilots. No, these demands did not remain merely a "paper" declaration. Certain measures were taken at the end of the 1960s and beginning of the 1970s. The scheduled annual total number of flying hours logged per pilot in Frontal Aviation had increased by 22 percent on the average by 1970, while the counterpart increases were 60, 43, and 30 percent in Army Aviation, Long-Range Aviation, and Military Transport Aviation.

One must agree that this was a substantial step forward. Backsliding subsequently occurred, however. Beginning in 1972 the total number of flying hours logged per air mishap in Long-Range Aviation, for example, began to decrease, in particular figures for Tu-22 [Blinder bomber] aircraft. Judging by all indications, contributing factors here as well included the complexity of this aircraft and the incredible cramming of the aircraft operating manual with numerous restrictions and bulky sections describing response actions in emergencies, of which there were dozens. And yet each of these is evidence of the aircraft's admitted unreliability. What qualities must a pilot possess in order to take all these restrictions and situations into account in his flying activity?

The average number of hours flown per air mishap was only 8,000 for MiG-23 aircraft, with a total of 1.5 million hours logged. During this same operating period this figure never exceeded 7,000 hours for the MiG-21, while it was about 10,000 hours for the Su-24.

In addition, when we state a 62 percent increase in total Air Force flying hours logged in the period 1965 through 1988, one must bear in mind that the leading factor in this increase was the Air Force schools (total hours flown increased by a factor of 2.2). The increase was 1.4-fold in Army Aviation. It was only 11 percent in Frontal Aviation (from 1970), while the number of hours logged per air mishap reached a figure of only 12,300 hours.

Judging from investigations conducted by Flight Safety Service specialists, reliability of Frontal Aviation flight personnel and aircraft remains the poorest. Even today we face many problems in the way of ensuring that pilots log 150-160 flying hours per year in fighter, fighter-bomber, ground-attack, frontal-aviation bomber, and reconnaissance aviation (a scientifically-validated optimal number of hours). Recommendations based by scientific research efforts on the advisability of flight personnel flying nine training sorties per week (a minimum number of gross errors is noted with this frequency) have not yet been implemented. The average

number of annual flying hours by a Frontal Aviation pilot remains low. And yet without increasing the number of hours logged, it is naive to expect a fundamental change in the state of affairs regarding flight safety. the interlinkage here is obvious: you cannot construct a strong building on a shaky foundation.

What Do We Want to Have?

What is impeding the process of raising the level of professionalism of flight personnel? First and foremost it is the limited capabilities to provide military aviation with the required quantity of fuel and long-lived powerplants. I shall state at the outset that we shall endeavor to answer this question without considering the methodological shortcomings of the combat training system. As third-generation and fourth-generation aircraft entered operational service with line units, there occurred an increase in the per-hour consumption of jet fuel. In spite of the fact that allocations of jet fuel for the Air Force were increased by a factor of 2.3 in comparison with the 1965 figure, the shortage of jet fuel is felt very keenly today. And this is occurring in a country which ships abroad immense quantities of oil! According to figures provided by military scientists, in order gradually to increase the number of flying hours logged in Frontal Aviation by 30 percent over the course of five years, it will be necessary to obtain an additional 280 million rubles worth of aviation fuel.

It is understandably no simple matter to obtain this money with the current state budget deficit. In connection with this there is a real danger that, subjected to persistent attacks by the "front-line" press: "The hell with the gluttonous Air Force. What purpose does it serve: it doesn't plow, doesn't sow, and doesn't reap. Cut up the airplanes!", influential forces will once again be found in the top echelons of power which are willing to chop military aviation down to the roots by a stroke of the pen. And then, while saving millions for the moment, later it will be necessary to expend billions and to apply superhuman efforts in order to compensate for the scientific, military-strategic, and economic losses to which such a decision will inevitably lead. We have already experienced such a thing in the past: we might recall Khrushchev's voluntaristic decision to cut back the Air Force. And we might also ask ourselves the following question: should we clip the Air Force's wings in a situation where reduction of missiles of various types is in progress? I believe the answer is obvious.

There is another important problem affecting the professional training of combat pilots: the additional delivery of aircraft engines to the units. According to a preliminary estimate, these requirements will run to several thousand engines. Add to this the supplying of regiments with spare parts, increasing the production facilities at maintenance depots, specialist personnel payroll, etc. An economic analysis indicates Air Force internal resources are too meager to solve this problem with these resources alone. It is so urgent and so complex that clearly the government should deal with it. I am directing this statement to Air Force people who are members of the USSR Supreme Soviet.

Let us set aside chauvinistic arrogance and take a look at how this situation is in the United States, the leading nation of the NATO bloc. For a long time now the U.S. Air Force has been applying a tough approach to pilot professional competence. A minimum number of flying hours has been specified for each sixth-month period, and a minimum number of flights has been specified for each quarter. The maximum time between flights for a trained pilot is not to exceed 45 days. In addition, tougher requirements have been applied to time between flying for specific types of training. The standard is one and a half months, for example, for F-111 pilots flying nap-of-the-earth. The corresponding time for our Air Force, with the Su-24, is four months. We shall not even mention carrier-based aviation, which has been developing over the course of decades in the United States but which is just now being born in this country.

The Americans also have a somewhat different approach to determining pilot proficiency rating. A pilot who has logged at least 1,000 hours (300 of these in a line-unit combat aircraft) is considered an experienced pilot (corresponding to our 1st class level). Flight personnel who have logged less than 900 hours in the air are not authorized for very low level flight [200 meters or less]. Establishment of such tough standards pursues a principal aim of ensuring a continuous high degree of professionalism of flight personnel and to reduce to a minimum accidents caused by the "human factor". This is achieved on the one hand by a well-developed system of testing and verification, and on the other hand by providing material incentive for conscientious performance by all aviation personnel. That is, problems of combat readiness and safety are viewed as two components of a single whole and are addressed in parallel. Thus the costs of professional training are repaid many times over in terms of priceless human lives saved as well as the preservation of expensive hardware.

The Aviation Flight Safety Service of the USSR Ministry of Defense conducted studies, together with other organizations, which make it possible to determine the effect of aircrew flying hours logged on the frequency of repetition of nonfatal mishaps and fatal accidents. The following conclusions were drawn. Two thirds of air mishaps have involved pilots who had been logging fewer than 90 hours a year on the average. 75 percent of nonfatal mishaps and fatal accidents involve aircrews which have flown 45 hours or less during the preceding six months. More than 30 percent of air mishaps occurred during the first four years of a pilot's line-unit duty. Of course these figures require thorough, specialist study. But it would seem to be obvious right now that one of the main directions to take in efforts to improve flight safety is to bring into conformity the ideology of the combat training program of the individual air components and the level of flight personnel proficiency (knowledge, skills, abilities).

What Is Hindering Us?

It is no secret that Air Force line units are presently receiving operational deliveries of aircraft with a number of operating features which facilitate in-flight procedures but which at the same time dull pilot alertness. Naturally all these new features should be thoroughly mastered on the ground. But this requires decent training simulators.

Unfortunately all is not well, to put it mildly, with the design, engineering and manufacture of training simulators in this country. Training simulator systems are delivered to the units at a later date than the aircraft. Practically no simulator upgrading is done during an aircraft's entire production run, and for this reason the appearance of the simulator cockpit and the capabilities of the simulator equipment fail to match the actual aircraft's cockpit and capabilities. As a result flight personnel lack full-value training aids.

Increased advanced-maneuvers capability of fourth-generation aircraft have brought forward a new problem: the development of automated systems to prevent an aircraft from entering critical configurations as a result of pilot error. In order to reduce the number of accidents caused by mistakes by flight personnel, specialists at a scientific research institute of the Ministry of Defense, working together with Air Force higher educational institutions, conducted a specific-purpose scientific research project, which provides the capability, using onboard digital computers, to design and build active flight safety systems, which make it possible to analyze crew actions and to counter the dangerous consequences of pilot mistakes in piloting and aircraft operating procedures.

Adoption of this system offers considerable anticipated effect. In conformity with a joint decision (Air Force and Ministry of the Aviation Industry), a flight evaluation of system performance was to be made in 1987-1989, resulting in recommendations on acceptance for use on regular production aircraft. But dreams often fail to materialize! Unfortunately this important project is barely inching along. Are we going to end up not having modern technical devices not only providing warning but also ensuring flight safety? We would like very much to receive an answer to this and other questions from Ministry of Aviation Industry officials.

Thus according to figures gathered by the Aviation Flight Safety Service of the USSR Ministry of Defense, three problems are the most important at the present time (from the standpoint of preventing air mishaps involving the human factor). The first problem: increasing logged flying time, including perhaps with the development of an inexpensive modular aircraft. Second problem: a fundamental change in attitude by the Ministry of Aviation Industry toward the development of training simulator equipment. Third problem: adoption on new aircraft of active means of ensuring flight safety.

This is often discussed at various conferences. Few specific, meaningful steps forward have yet been accomplished, however. To a certain degree the foot-dragging is apparently being caused by a passive attitude toward scientific support of the requirements of flight safety. Matters pertaining to scientific support of methods of reducing accident figures are being handled by many of the scientific research institutes of the Ministry of Defense in an uncoordinated manner. Suggestions and proposals pertaining to a comprehensive solution to these problems are being worked out in a superficial manner. Virtually no implementation is being accomplished. Scientifically-validated flight safety standards are lacking, standards capable of comprehensively reflecting the level not only of reliability of existing aircraft but of flight personnel proficiency as well, and capable of showing the degree of conformity between flight personnel and the missions assigned to military aviation.

Unfortunately one must also take note of the following sad fact. There has not yet been achieved a unity of views of the various services and directorates even as regards the general concept of a plan for preventing air mishaps, which in large measure predetermine the role and place of problems of flight safety in the military aviation system. And since this is the case, selection of both strategy and tactics of accident prevention has been made difficult.

At the present time efforts aimed at improving flight safety are constructed primarily on the basis of standards, rules and procedures governing the activities of each component in the aviation system. There is no question that development and adoption of more advanced regulations, rules and procedures, manuals, training courses and programs are exerting definite influence on flight safety. Nevertheless the persisting lack of change in number of air mishaps, decline in the rate of increase of total flying hours logged per air mishap, and an increase in the number of prohibitions and restrictions attest to the fact that we are apparently somewhere in the vicinity of maximum effectiveness from standards-prescribing methods of ensuring accident-free operations.

This is also expressed in the fact that at the present time it is difficult objectively to assess the actual number of air mishaps, for the period from 1965 through 1975, for example. It has been proven that a significant percentage of mishaps were concealed during that time. The true picture of the accident rate was distorted right up to 1980. Investigations conducted by the former Central Flight Safety Inspectorate revealed several dozen unreported, hushed-up air mishaps. And the investigation covered only one half of the Air Force's large strategic formations. The results of an inspection of one large strategic formation, where the fact of approximately 20 mishaps was concealed over a period of five years (1975-1990), eloquently attest to the scale of deliberate concealment of air mishaps!

For the sake of fairness we should note that assessment of the condition of damaged aircraft became much more rigorous from 1982 on. This enabled Flight Safety Service officials to gain a more realistic picture of the state of affairs.

Experience indicates that air mishaps are rarely the result of a single cause. Critical in-flight situations occur as a rule when several factors, which at first glance are not always interrelated, coincide. It is not mere happenstance that in the majority of countries which are major air powers the essence of the overall plan and scheme of air accident prevention consists precisely in pinpointing and correcting these factors before they actually occur—simultaneously or in a fatal sequence.

From the standpoint of operational standards, this problem is handled in our military aviation by means of oversight and monitoring organization of flight operations. But even in this regard the services and directorates of the central administrative authorities have failed to reach a unity of views. As a result, in the first place, a great many standards-prescribing documents, which differ from one another, are in effect in the Air Force, Air Defense Aviation, and the Navy. Secondly, handling of figures on in-flight emergencies and near-mishap incidents involving aircraft boils down for the most part to working with a gross stream of numbers and the delayed issuing of informational publications.

Cause-and-effect linkage is insufficiently utilized. An important question has not yet been objectively answered: why did a given near-mishap incident occur? This is perhaps the weakest point in prevention efforts. In addition, there still is lacking in military aviation a unified, common approach to determining the degree of danger presented by near-mishap incidents. In 1988, for example, approximately 900 such incidents were reported in Naval Aviation. One out of every two such incidents was classified as a dangerous near-mishap. In the Air Force, however, only 300 out of 19,270 such incidents were classified as dangerous. The difference in these ratios is certainly puzzling!

What Should Be Done?

I shall venture to state a subjective suggestion. It is my conviction that the Flight Safety Service should be removed from the heavy hand of military aviation administration. As I see it, one alternative variation would be to make the Flight Safety Service subordinate to the USSR Supreme Soviet Committee on Defense and State Security Affairs. The experience of other countries confirms that this service should be an independent (from those whom it supervises), influential organization. Otherwise it will continue to constitute a unique office of powerless "semi-military bookkeepers," who tally and record nonfatal mishaps and fatal accidents with an eye toward the higher echelon.

The second thing which in my opinion should be done is to change the end goal of accident investigation. At the present time the main objective in investigating a near-mishap incident, nonfatal mishap, or fatal accident is to find the guilty parties and to draw up an order of punishment, rather than to get at the root cause of the incident and to determine what preventive measures should be taken. This is the reason for military aviators' constant fear of commanders and Flight Safety Service officials and an endeavor to get out of responsibility by any means possible, including falsification of information and confusing the investigation. For this reason a near-mishap incident or accident as a rule boils down to pilot error. I think this is in large measure due to the fact that the following situation currently prevails in our military aviation: as soon as a pilot enters the cockpit, a sword is immediately raised above his head, a sword held by commander, political agency, and Flight Safety Service official. In such a psychological state, just try to fly without mistakes!

I have long since been convinced that if we want to achieve any objectivity and professionalism at all in such an important matter as flight safety, duly-empowered flight safety service representatives should handle investigation of accidents and serious near-mishap incidents. These should be highly-trained, honest, unprejudiced (and this means independent) professionals. This will require correcting this service's table of organization, which has been greatly cut back by ill-conceived cuts. Otherwise, while attempting properly to organize preventive efforts in the campaign for accident-free flight operations, we shall suffer failure back on the far approaches to air mishaps.

It is a long-known fact from worldwide accident prevention experience that preventive efforts in aviation should be distinguished by aggressiveness. Unfortunately the Flight Safety Service lacks the capabilities promptly to communicate necessary information to the units. It takes a long time to prepare the quarterly reports for publication, and the materials contained in these reports are frequently superficial and based on distorted information. As a result they as a rule address only the periphery of the problems. In addition, they are classified, and in conditions of a heavily-loaded workday, military aviators simply lack the time and desire to read them. In connection with this it is high time for the Flight Safety Service to publish an unclassified illustrated journal, which would become a substantial operational aid for every military aviator. For the sake of example, the counterpart organization in the United States has six publications which thoroughly, comprehensively, and openly discuss both problems of flight safety and ways to solve them.

...Thus a system of measures of a preventive nature, grounded on objectivity, should constitute the principal content of work efforts to prevent air mishaps. A very important part of this work effort should be played by a correct understanding of the essence and substance of problems connected with the human factor. In other words, it is time to acknowledge legislatively the objective probability of pilot error. I shall spell it out in detail

specifically for politically-conservative demagogues: one's attitude toward pilot error should be not aggressive but be grounded on psychological analysis of an incident. Otherwise we shall never be able to change today's realities. And they are as follows: if the pilot survives, he will be finished off by the investigation of the incident.

Of course the above does not mean that there is a fatal inevitability of air mishaps. That is not my point: such incidents can and must be reduced to a minimum, and the entire system of ensuring mishap-free flight operations must be radically restructured. In my opinion one should bear mind thereby that a plan based on an endeavor to achieve the desired results solely by the efforts of an administrative agency will not improve things, if only because it will be hard for flight personnel to believe in such a plan, since they are artificially separated from such an operation. There is the apprehension that this document will be perceived by pilots as one more instance of pressure applied from the higher echelon. This should not be allowed.

Unique Approach

90SV0038H Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 90 (signed to press 29 Apr 90) pp 20-21

[Article, published under the heading "Flight Safety: Specialist's Advice," by Honored Test Pilot USSR Col B. Oleynikov, engineers Lt Col V. Ziberov and Sr Lt A. Kupriyanov: "Unique Approach"]

[Text] **Honored Test Pilot USSR Col B. Oleynikov and engineers Lt Col V. Ziberov and Sr Lt A. Kupriyanov offer an original approach to providing information support pertaining to actions to take during in-flight emergencies, for consideration by aviation personnel.**

We know that in a difficult in-flight emergency situation correct response actions by the aircraft commander and the members of his crew depend not only on a high degree of proficiency but also on the ability promptly to grasp the situation, to evaluate incoming information, and to make a decision which ensures a safe outcome. It has been established that external signals do not immediately evoke a response reaction but are compared in a certain manner with one another and with models (images, concepts) which are recorded in memory and are actively reproduced in one's consciousness. In connection with this, assimilation by flight personnel of a large number of decisions prescribed by numerous manuals and regulations and selection of an optimal variation for a specific situation is a fairly complex task.

Ways to select the correct decision proceed from the logical structure of a given manual or set of regulations, which are frequently presented as programs of sequential actions. One should not forget, however, that no document can take the place of aviation personnel instruction aimed at assimilation of the profound cause-and-effect relations from which a given phenomenon or action proceeds. Manuals, diagrams, procedures check lists, and charts containing crew actions in response to in-flight emergencies help reinforce acquired knowledge and help form and shape precise criteria for situation evaluation with subsequent decision making.

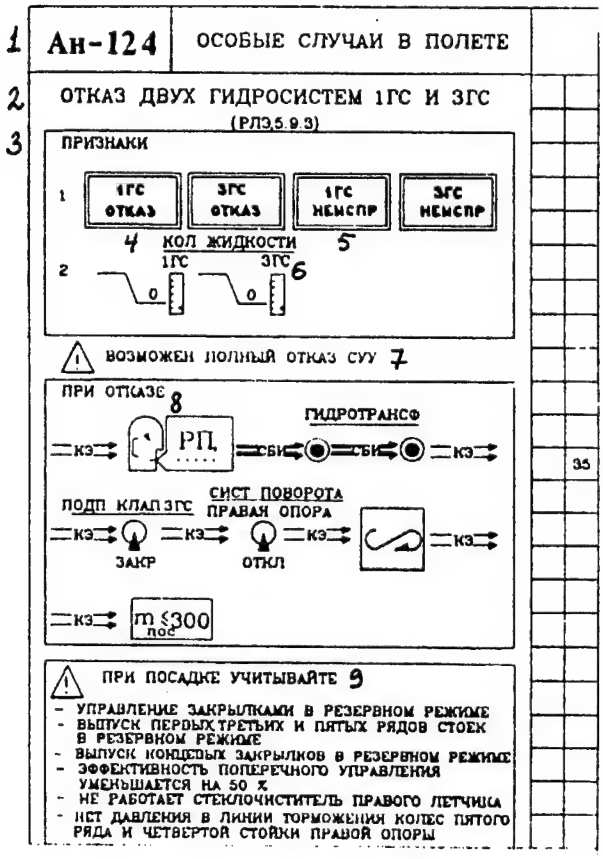
These documents are sometimes useless, however, when certain circumstances, connected with the development of a critical situation during flight, occur in conjunction with one another. It is not mere happenstance that a significant percentage of air mishaps and near-mishap incidents have occurred because the crew had not received prompt, easily-understood instructions on response actions in emergency situations. An aircrew and air traffic controller information support system based on utilization of technical documentation in textual form is not particularly fast or efficient.

We propose a new form of information support for technical documentation and for ground and airborne electronic display systems, based on a fragmentary-pictographic method (F-P method) of information display. It consists essentially in coding (display in the form of combinations of pictograms—characters, symbols, as well as text) of information and its separation or division into individual fragments which are interlinked into a logical sequence.

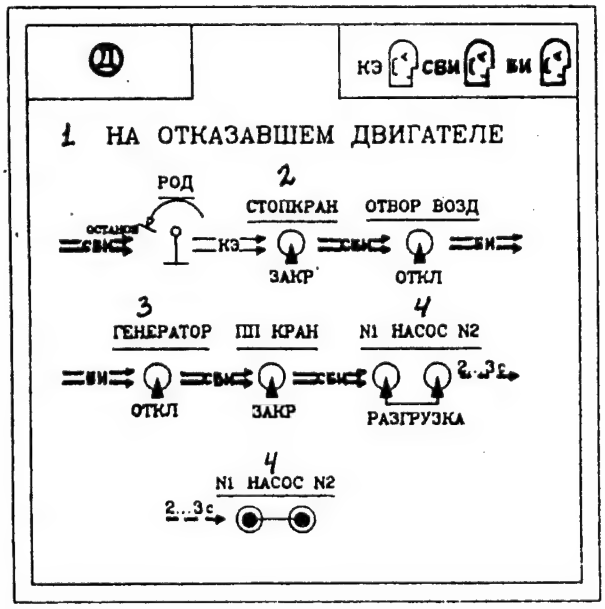
This method is grounded on the principles of an optimal information model: as regards content, it should adequately depict control and environment items. As regards quantity of information, it should ensure an optimal information balance and not lead to such phenomena as too little information or information overload. In form and composition it should correspond to the operator's control tasks and his psychophysiological capabilities to receive and process data. The human operator's psychophysiological features are taken into consideration, such as the fact that vision, by which he receives more than 80 percent of all information, perceives an image fragmentarily, isolating the contours which contain the most important information on the image. It has been established that techniques of fragmentary presentation of information utilizing pictograms graphically presented in a contour form greatly facilitate information perception and processing.

Technical documents prepared with the assistance of this method can be in the form of a set of blank cards or charts of various type: informational (IK), operations (OK), and auxiliary (SK). IK are for presenting information of a descriptive nature; they provide the operator with information on functional designation, structure, and interlinkages of subsystems and the technical system as a whole. OK constitute a description of the process of operator actions within the framework of the "man-machine-environment" system, with the aim of obtaining a specified result. SK constitute a catalogue of technical system IK and OK.

Figure 1 shows an operations diagram (An-124 aircraft in-flight emergencies) titled "Failure of Two Hydraulic Systems, HS 1 and HS 3," set up for a paper-type data medium. Figure 2 contains "Engine Failure," set up for a cockpit engine instrument and caution advisory system and ground controller electronic color display system.



Key:
1. An-124, In-Flight Emergencies
2. Failure of two hydraulic systems: HS 1 and HS 3
3. Symptoms
4. Failure
5. Malfunction
6. Fluid level
7. Complete failure of hydraulic servo unit control possible
8. In case of failure
9. Consider the following when landing: flap control in backup mode; extension of main gear wheels in rows 1, 3, and 5 in backup mode; extension of outboard flaps in backup mode; lateral control effectiveness reduced by 50 percent; copilot's windshield wiper does not function; no pressure in brake hydraulic line for main gear wheels in row 5 and right-side wheels in row 4



Key:
1. On Failed Engine
2. Fuel shutoff valve
3. Generator
4. Pump

Color plays a special role here. Each crew member has his own color. The action, check, and wait lines bear the color of that crew member who is to perform at a given moment a given manipulation of aircraft system controls. On the basis of conducted studies, we can state the following advantages of using this method: graphic display: all information is concentrated on one or two blank-form charts and is visually perceived as a complete fragment; unambiguous interpretation of information even with a substantial number of logical linkages; optimal information density per unit of medium, which can be twice or more the density of tradition technical documents, which has made it possible to develop an RLE [expansion unknown] "pocket" model version.

One of the principal advantages of our proposed method is the possibility of extensive utilization of computers, including personal computers. The information contained in an airborne (ground) computer display makes it possible to improve the quality and efficiency of the work performance by an aircrew (ground controller) during in-flight emergencies. Utilization of information obtained with the aid of the F-P method makes it possible substantially to reduce the probability of crew (pilot) error and to increase the effectiveness of instruction and conversion-training of flight and technical personnel over to various types of aircraft.

In addition, the form of aircrew information support we are proposing can be utilized effectively in airborne and

ground monitoring systems, as well as in future aircraft expert (information) systems being developed in this country and abroad. All this will have a positive effect on flight safety.

The Defenders Need Defending

90SV0038I Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 90 (signed to press 29 Apr 90) pp 38-39

[Article, published under the heading "Facing the Problem," by Col A. Fedulin, candidate of philosophical sciences: "The Defenders Need Defending"]

[Text] **The war in Afghanistan, interethnic conflicts in Transcaucasia, separatist and anti-military attitudes in the Baltic, and reduction of the Armed Forces have aggravated the already difficult problem of social protection for military personnel. Measures taken in recent years to improve housing and living conditions and the financial status of officers and warrant officers, as well as exposing of slanderous rumors and fanciful conjectures about the military, have only partially and temporarily defused the situation. A radical change in the situation, however, is possible only with the adoption of laws and other enforceable enactments which define the legal basis of Armed Forces life and activities, the rights and duties of military personnel. What is needed is a strong, reliable shield of legal guarantees for the defenders of the homeland.**

The myth of the social well-being and even prosperity of our society, which had existed for decades, has scattered like the morning mist, yielding to the warming rays of glasnost. It was quite a revolution for many people to learn that, according to world statistics, based on generally-accepted criteria of social protection, we stand somewhere between 30th and 40th place in the world rankings.

The social status of military personnel and the members of their families (by reason of the specific conditions of life and work of Armed Forces personnel) appears even worse against the background of these "achievements." And it is highly unlikely that anybody will seriously dispute the fact that the people in uniform are today the least protected segment of our society. It is not surprising that an aggravated sense of lack of social protection on the part of officers and their families and the need to raise the prestige of the military and military service have been noted at congresses of USSR People's Deputies, at sessions of the Supreme Soviet, and at the February (1990) CPSU Central Committee Plenum. This indicates that the problem has been acknowledged as a national issue and a problem of concern to the party as a whole, and that resolution of this problem has been designated as one of the priority tasks of perestroyka.

Nevertheless the campaign to discredit the Armed Forces, which is actively supported by a number of newspapers and magazines, TV programs, unofficial associations and groups, has not disappeared. The public has formed a distorted notion of the problems of military personnel and their families. Frequently our demands for social justice and legal protection are represented by demagogues as a desire by the military to snatch a larger piece of the pie. They ask: just what more do they want?

Just what does the term "social protection of military personnel" encompass? In the broadest meaning of the term it applies to creating conditions in which military personnel live and work which are favorable in all respects, the existence of firm social guarantees on labor, rest and recreation, education, housing, pension benefits, inviolability of the person, as well as a guarantee of protection of the soldier's honor and dignity.

There are those who might ask: are we not seeking to hide behind a shield of social guarantees from the burdens and privations of military service? I would imagine that there will be plenty of difficulties as long as the military continues to exist. Field exercises, redeployments, and reassignments cannot be avoided. But I do not feel that one can justify by any references to the military oath and military regulations the many years of wandering by military personnel from one remote duty post to another, the length of the workday for the pilot and technician, which runs from dawn to dark, as well as other adversities with which many officers, warrant officers, and their families are so familiar.

The military, and particularly military aviation, is a motile, rapidly developing organism. A process of technical renewal and improvement is constantly in progress. Unfortunately at the present time man is assigned the role only of specialist in this organism. Billions are being spent on building and mastering the operation of new fixed-wing and rotary-wing aircraft and weapon systems, but that same old "residual" principle is still in effect as regards aviation personnel. Military personnel are constantly feeling its consequences, especially in the social, cultural, and services domain.

Should one anticipate changes for the better in the near future? That depends on many factors. We can see with what difficulty new laws are passed, for example. But even the very finest law is not the entire answer. What are needed are specific conditions and means in order for the law to be able to function.

It is planned to spend 21.8 billion rubles this year on military personnel maintenance costs, which comprises approximately one third of defense appropriations.

For purposes of comparison, in the United States 166.2 billion dollars will be spent on this, or 50 percent of the military budget. Of course at the present time we could not manage such expenditures, but experience in forming and "item-by-item" distribution of budget allocations could come in handy.

Problems are mounting rapidly in the military. The housing problem is acute. According to Ministry of

Defense figures, 173,000 military personnel are without housing, including 39,000 Air Force personnel. More than 74,000 military personnel need improved housing conditions. Even at garrisons which are fairly well off, one out of every three or four officers is on a waiting list for housing. The situation is becoming worse with the withdrawal of units and subunits from the groups of forces and with reduction of the Armed Forces.

Housing and other problems with daily life adversely affect people's mood and attitude. Many are in a state of high nervous stress. And a "wound-up" pilot means inevitable mistakes, near-mishap incidents, nonfatal mishaps, and fatal accidents. Should we not look in the poor provision of social, cultural, housing and personnel services for one of the reasons why our pilots are grounded from flight duty a good 10 years or so earlier than their U.S. counterparts? And yet it costs a lot of money to train a combat pilot.

It is true that there has been some movement forward in solving social problems. For example, 1,200,000,000 rubles have been specifically allocated to the Armed Forces. These funds are to be used to increase military personnel dolzhnostnoy oklad [pay based on billet or position] by an average of 50 rubles, to pay from 15 to 25 rubles per month compensation to specialist personnel for proficiency rating, as well as a 30-percent addition to flight personnel pay for special conditions of duty. there has been a pay increase for military personnel standing alert duty and performing duty in field conditions. There has been introduced partial compensation for subleasing housing. Mustering-out pay has been increased, including for compulsory-service personnel, who now receive 100 rubles. This may not be very much in view of the present times and current prices, but it is important as a first step.

The USSR Ministry of Defense is also stepping up its activities in this area. In the last two years more than one third of total funds allocated to the ministry for capital construction has been channeled into development in the social domain. In the near future this percentage is to increase to 46 percent, and to 70 percent in the Air Force. The housing problem for flight personnel is to be resolved by the end of this year, although, I should note, this task was designated by the Minister of Defense for 1989. A total of 4,074,000 square meters of housing, or 73,700 housing units, are to be built for the Armed Forces as a whole. A total of 415,600 units are to be completed in the 13th Five-Year Plan, and 450,000 units in the period 1996-2000.

It was once again emphasized at the March (1990) Central Committee Plenum that a specific national-level program of Armed Forces social development is essential in order to accomplish radical resolution of problems. It was suggested that implementation of this program be placed under the oversight of the President of the USSR. Of course a great deal here will depend on a responsible attitude on the part of ministries and agencies, and on the position taken by Soviets of People's Deputies, commanders, and political agencies. At the same time I believe that party and Komsomol organizations as well as Assemblies of Officers must do everything they can to prevent machinations of any kind in the distribution of newly-built housing.

We need legal guarantees that the military and every member of the military will be utilized strictly to perform their intended functions. Instances of using personnel of military units and subunits to work at enterprises, on kolkhozes, to build vacation homes, garages, and to repair apartments for civilian personnel and military officials should be considered acts of malfeasance. At the same time every effort must be made to develop creative-achievement [tvorcheskiye] and business contacts, patron assistance by military units to children's homes, hospitals, schools, and military-patriotic associations, to establish at Air Force garrisons young aviator clubs, technical study groups, and sports sections, enlisting young people from nearby towns and villages. Everything which helps improve the image of the military with the people, implementation of principles of charity and compassion, and which furthers education of the younger generation is our vital concern.

Here is a reasonable question: where can time be obtained for civic activities? I feel that military personnel, just as all Soviet citizens, should have a regular work week, and overtime work—if its need is not dictated by performance of combat missions, the conduct of field exercises and other special conditions specifically covered in the appropriate guideline documents—should result in additional pay or compensation by increased leave.

As we know, reduction of military forces is continuing, including the planned and scheduled discharge of officers and warrant officers based on age criteria. The majority of these can work successfully in the civilian economy. But whose job is it to be concerned with the retraining of and finding jobs for personnel discharged into the reserves? The Ministry of Defense? Local soviets of people's deputies? At the present time there is no clear answer to this question, just as there are no specific actions on the part of the agencies named above.

There is another related problem. Is it really necessary to hold in the military by force an officer who has become disenchanted with military service, who made a mistake in career choice? Practical experience indicates that such people leave the military in any case, having shattered their own nerves and those of their colleagues. I feel that career military personnel should have the right to discharge without any artificial obstacles. In addition, this will compel this country's leaders and Ministry of Defense officials to face the problems of officers.

The system of rule by administrative fiat has given rise to many negative phenomena in the military environment, including in the domain of mutual relations among military personnel. The processes of democratization and glasnost have unquestionably shaken the

foundations of the vaunted principle "The boss is always right!" But the influence of the subjective factor on the life of the military collective and on the service of military personnel sometimes goes beyond the framework of generally accepted standards of social intercourse. And these boundaries are extremely arbitrary and vague to boot.

I feel that military personnel should have adequate guarantees against persecution for criticism of persons in authority and against the settling of personal scores. It is also important to work out a mechanism of objective evaluation of the individual, duty assignments and promotions, reward and punishment, assignments to study and duty assignments abroad, as well as distribution of goods and benefits. Unfortunately personal likings and antipathies, "telephone" authority, nepotism, favoritism and protection in these matters have not yet been eradicated. As sociological surveys indicate, very few military personnel believe that fairness and glasnost are observed in personnel matters. Dozens of surveyed individuals are undecided in their opinion. And the overwhelming majority note a lack of any justice or fairness.

I do not believe that we have so many aggrieved individuals. But they unquestionably exist, and this very fact engenders a syndrome of mass lack of belief in social justice and human decency.

All these and other problems of the military, military personnel and their families demand the earliest possible resolution. As I have already stated, Air Force personnel are watching hopefully and attentively the activities of our legislators and expect of them a responsible and businesslike approach to matters of defense and strengthening the Armed Forces. But one should not forget that it is the direct obligation of commanders, political agencies, party and Komsomol organizations, agencies of military justice, and supporting services to solve problems pertaining to social protection of military personnel.

There also exist in military collectives numerous social institutions which are called upon to protect and defend when necessary the rights of military personnel and their families. I am talking about the Assemblies of Officers, public oversight committees and posts, women's councils, veterans committees and councils, and other mass-membership public organizations. At the present time they are largely without powers, and they are sometimes simply inactive. Of course a well-defined legal foundation for their operations is needed. But also important is the position taken by activists and military personnel themselves.

Let us be frank: during our time in the military have very many of us dared openly and persistently fight for our rights, our honor and dignity? There are few such bold individuals in any given military unit. And the system has had no difficulty in crushing individuals. The majority prefer to bide their time. Maybe there will be changes, maybe their superior will be removed or promoted out elsewhere, or else one will make it to retirement....

I feel that there is good reason for the fact that the vaunted "Shield," otherwise called the Union of Social Protection of Military Personnel and Military Reservists, has bobbed to the crest of the wave of political passions. The organization's name is impressive. But what kind of substance does it have? It is my conviction that the leaders of "Shield" have been counting on people's suffering, old grudges, and a thirst for justice, that is, they have played their card on the deficiencies of our system of social protection of military personnel. Seeking to profit on the noble ideas of others, as well as from slogans, they are waging an open struggle for power, for control over the Armed Forces, to achieve the selfish aspirations of the leaders of this organization.

Since neither "Shield" nor other such organizations have any real capability to solve military problems, they engage, for purposes of self-publicity, in "exposing" negative phenomena and hold mass meetings in defense of "aggrieved" military personnel, such as Maj (Res) N. Moskovchenko, former staff member at the Air Force Engineering Academy imeni N. Ye. Zhukovskiy. Such propaganda maneuvers are dangerous and harmful, as I see it, in the fact that they create the illusion of the existence of certain supragovernmental forces capable of defending the rights of military personnel. All this is plain old demagoguery.

Only refined laws grounded on the economic power of the state and an effective system of social protection of each and every Soviet citizen can resolve, concurrently with the problems of our society, matters pertaining to the social protection of military personnel. We shall state quite frankly that this is a very complex task, inseparably linked with restructuring of literally all domains: economic, spiritual, military organizational development, and others.

Playing Secondary Roles

90SV0038J Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 90 (signed to press 29 Apr 90) p 40

[Article, published under the heading "A Reader Suggests," by Capt V. Pusev and Sr Lt Yu. Kvilinskiy: "Playing Secondary Roles"]

[Text] **Young communications specialist officers sometimes find themselves playing secondary roles. Why is this?**

One of us happened to take over command from Sr Lt A. Gaydar a telegraph and telephone communications platoon of a separate communications and flight operations

electronic support services battalion. This combined-arms communications command school graduate displayed diligent effort during his first years and endeavored to gain a deeper understanding of the specifics of Air Force operations. After five years, however, this officer cooled off toward military service and was discharged into the reserves.

Approximately the same thing happened with Sr Lt V. Ryabov. Sr Lts A. Ivanichkin and A. Osmerkin also occupied billets of this type for more than 10 years, but were ultimately removed for "professional incompatibility."

Why does this happen? It seems to us that it would not be entirely correct to look for the cause in subjective factors alone. It is also improbable that all those who have failed happened to get "bad" commanding officers, for many graduates of the Kharkov Higher Military Aviation School of Electronics have done a fine job.

First of all, while not stressing the general shortcomings in training officers at combined-arms communications command schools, we shall note that they essentially do not train such specialist personnel for military aviation, but rather focus on the USSR Ministry of Defense Signal Troops. Future officers, including those who ultimately serve in military aviation, study ground forces tactics and receive specialized troops tactical training in signal units, beginning with the separate battalion. For this reason, in addition to difficulties with professional development which are common to all young specialist personnel, the burden of aviation-specific subjects is dumped on the shoulders of the communications command school graduate: aircraft approach and landing electronic support services, observance of flight safety procedures and regulations, VHF/UHF radio communications, detection and position finding, navigation, and airfield lighting and illumination service system.

It is difficult even to imagine such a specialist as designated duty officer for communications and flight operations electronic support services. Thus we feel that he is automatically set apart from the fully-empowered officers of his billet equivalent in the unit, which has a strong negative effect on his pride and limits his career prospects. By remaining in a secondary role, an officer suffers a loss of image and sees no point in his military service.

Training at service school is figured for service in high-echelon organizational components with a highly-organized system of maintenance and division of labor. And yet all the officers mentioned above failed to encounter the anticipated structure of communications organization. As a result, being simultaneously both organizers and executing individuals, they are unable in practice to provide highly-skilled servicing and maintenance of cable lines, to perform technical procedures on cable lines, to record or register line status. And equally important is the fact that they are not capable of independently handling the job of organizing telegraph and telephone communications which, incidentally, is not required of a platoon commander in a combined-arms battalion. Things are additionally complicated by the fact that a young specialist has nobody from whom he can ask advice, since the air unit officers are unacquainted with the platoon's equipment.

Is there a solution to this problem? We feel that it is necessary to abandon the principle of "more for less." To accomplish this, perhaps one should move from unwieldy standardized, unchanging forms of training specialist personnel to the establishment of new local components which would foster initiative and innovation. At the Ryazan Higher Communications Command School, for example, they have long been training "tailor-made" specialist personnel: a platoon for the Airborne Troops is graduated each year. But why should other service schools not graduate aviation communications specialists? Nor would this be very expensive. In our opinion it would be sufficient to make appropriate changes in the curriculum, to introduce a tour of duty at a military airfield, etc. This would be very beneficial.

The problem we have touched upon is complicated and of considerable urgency, and must be resolved, for young communications-specialization officers come into the Air Force every year. What awaits them? Disenchantment and hopelessness, or a bright, clearly-defined prospect for professional and career advancement?

Commentary by Lt Gen Avn G. Ulyanov, Air Force Chief of Communications and Electronic Support Services Troops

First of all I should like to comment that graduates of combined-arms communications command and engineering schools are for the most part highly-qualified officers who are professionally well trained and prepared. At the same time, as the authors of the letter note, the specific features of service in the Air Force require of each such officer knowledge not only of general communications equipment but of various electronic support services equipment as well, and the fundamentals of combat employment of aircraft systems. All this of course places an imprint on their job duties, especially during the initial period. For this reason I can understand the concern on the part of Capt V. Pusev and Sr Lt Yu. Kvilinskiy.

But at the present time approximately 35 percent of supervisory personnel in the line units and approximately 40 percent of unit commanders are graduates of combined-arms communications command schools. And in my opinion an unequivocal conclusion is suggested: everything depends on the officers themselves. As practical experience indicates, these officers, possessing basic specialized training, are capable, under the guidance of experienced commanders, of mastering the specific features of organization of communications and flight operations electronic support services, and the capabilities of electronic support services assets. Specialized training courses are organized each year for this

very purpose, and advanced training courses for graduates of combined-arms communications command schools will be offered at the Kharkov Higher Military Aviation School of Electronics starting in 1992.

Meriting attention is the authors' suggestion that specific training be provided for that segment of cadets at combined-arms communications command schools who will be assigned to the Air Force, as well as organization of a tour of duty in a line unit at military airfields for these cadets. This problem will be worked on.

Thus the prospects for career advancement are approximately equal for officers who have graduated from Air Force and combined-arms communications command schools and are determined by their purposefulness, ability to master new types of arms and equipment, their personal initiative and innovativeness, and their ability to work with their subordinates. As for specific complaints by young communications-specialization officers, the Air Force Communications and Electronic Support Services command authorities are always willing to give thorough consideration to complaints and to make an appropriate decision.

The Unknown "Item 100"

90SV0038K Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 90 (signed to press 29 Apr 90) p 41

[Article, published under the heading "History of Soviet Aviation," by Doctor of Technical Sciences N. Chernyakov, chief designer of the T-4 aircraft: "The Unknown 'Item 100'"]

[Text] It is the fall of 1972. A new supersonic missile-platform jet aircraft, the T-4 (Item 100), designed by the Special Design Bureau imeni P. O. Sukhoy, stood poised on the flight testing institute airfield, wreathed in smoke from peat bogs which had been burning for several days in the Moscow area, waiting in anticipation of its maiden flight. Our wearisome wait ended on 22 August, when visibility finally improved, and Chief Pilot Hero of the Soviet Union V. Ilyushin, accompanied by Honored Navigator USSR A. Alferov, took the T-4 aloft.

Everything about the new aircraft was untraditional and unusual. One was particularly struck by the elegance of its shapes: its long fuselage, stretching 45 meters without a protruding cockpit canopy, the fuselage cylindrical in shape, 2 meters in diameter, with a droop nose to improve cockpit visibility on takeoff and landing, its thin, highly-swept wing, triangular in planform, with a sharp leading edge and substantial wingroot strake.

The birth of this aircraft did not come easy. It was necessary to solve many new technical and organizational problems in a short period of time, while the necessary facilities for designing and building the aircraft were virtually lacking. At the same time the minister of the aviation industry and his administrative staff were not giving us much support, and the project had opponents even within the design bureau: the traditional-design Su-24 frontal-aviation [tactical] bomber was being developed at the bureau as a parallel project. Here is how things began. Back in the 1960, when the United States was already flying prototypes of the XB-70 strategic bomber and the SR-71 reconnaissance aircraft, the USSR Ministry of Aviation Industry assigned the Tupolev, Yakovlev, and Sukhoy design bureaus the task of developing a supersonic missile-platform bomber on a competitive basis. Involving the Yakovlev and Sukhoy companies, which specialized in designing fighters, caused some puzzlement in aviation circles. Soon everything became clear, however: it seems that the minister had no intention of building such an aircraft. He wanted to know how such an aircraft might look in designs produced by the fighter aircraft designers, in order to obtain the necessary arguments against the project as a whole. But events failed to develop according to this scenario.

The results presented by the three design bureaus were carefully studied by the appropriate institutes and were discussed by the ministry's scientific and technical council. The Yakovlev Design Bureau's design was soon rejected. Subsequent debate focused on selecting a cruising speed. Two variations were being considered: 2000-2300 km/h (in which case the airframe could be fabricated of aluminum alloys), or 3000-3200 km/h (this would require steel and titanium). The second variation, proposed by the Sukhoy Design Bureau, was adopted. In addition, the aircraft they proposed offered greater combat effectiveness and superior aerodynamics.

Just what brought the T-4 into the arena of Soviet aircraft engineering? There was perhaps not a single aircraft in the country which would contain so many new innovations. This was due to the need to support a cruising speed of 3000 km/h and to overcome the so-called thermal barrier, whereby the airframe would heat to a temperature of up to 300° C. The proposed broad range of operating airspeeds required painstaking design of aerodynamic configuration. For this reason more than 20 different aircraft design variations were studied in the wind tunnels of the Central Institute of Aerodynamics and Hydrodynamics, as well as a great many variations of individual components: wing, fuselage, engine nacelles, and their mutual positioning and combination. Test results were verified in the course of Su-9 flying laboratory test flights.

"One could talk at length, and using only superlatives, about the aerodynamics, stability, and controllability of this remarkable aircraft," stated its first pilot, V. Ilyushin. "And the fly-by-wire control system was a particular delight for the pilot. But the system had to fight its way to adoption. There were no problems from a technical and ideological standpoint, but not everybody, including specialists at the Central Institute of Aerodynamics and Hydrodynamics and at the Flight Testing

Institute, was of the view that it was possible immediately to adopt this totally new system. What if something happened? And for quite some time approval was not obtained for takeoffs and test flights."

At first the airframe was of a welded construction, of titanium alloys and high-strength stainless steel, with extensive employment of sheet blanks, from which not only the skin was fabricated but also various structural sections, frames, and curved-surface panels. The aircraft was powered by four turbojet engines developed by the Rybinsk Engine Design Bureau (chief designer P. Kolesov). They were placed in a single engine nacelle, two sharing each intake duct.

The fuel system incorporated fundamentally new hydraulic turbine pump units. A liquid-nitrogen neutral gas system was used for the first time, to protect the fuel tanks against explosive combustion from heating, and additional new innovations included emergency fuel drain and bellows-type high-temperature fuel line flexing connections.

The T-4 aircraft was equipped with several avionics packages: a navigation package, based on a celestial inertial navigation system with board display and multifunction control panels; a target engagement package, based on a forward-looking radar with long-range detection capability; a reconnaissance package, incorporating optical, infrared, and radar sensors, as well as side-scanning radar, used for the first time. Integration and automation of airborne systems control were so great that it was possible to limit crew size to a pilot and a navigator/weapon systems officer. We should also mention the highly-efficient missile developed at the design bureau specifically for the T-4, with solid-propellant motor, terminal-guidance seeker, and rebound-type flight path, which increased effective range.

Just what was the fate of the "one hundred," which was in many respects ahead of its time? Testing was suspended in 1975. The aircraft made only 10 flights, and was placed on exhibit at the Air Force Museum at Monino (Moscow Oblast). Fifteen years have gone by, and yet aviation experts still express regret over the totally inexplicable decision to terminate development on the T-4. Even today it could be serving honorably in this country's Air Force. After all, its contemporary, the U.S. SR-71 reconnaissance aircraft, was successfully flying until quite recently. Nevertheless the millions of rubles spent on this aircraft were not wasted. Many technical achievements and the ideas embodied in it were utilized in the designs of aircraft of succeeding generations.

Specifications and Performance of the T-4

Standard takeoff weight, carrying two air-to-ground missiles, tons	114
Maximum takeoff weight, carrying two air-to-ground missiles and an external fuel tank, tons	135
Cruising speed, km/h	3000
Maximum airspeed, km/h	3200
Range at cruising speed:	
-at standard takeoff weight, km	6000
-at maximum takeoff weight, km	7000
Basic wing area (excluding wingroot strake), sq m	290
Thrust-to-weight ratio at standard takeoff weight (engine thrust 4 x 16 t)	0.56

Air Force Cosmonaut Detachment

90SV0038L Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 90 (signed to press 29 Apr 90) pp 46-47

[Listing, published under the heading "Readers' Request": "Air Force Cosmonaut Detachment"; part two of three-part listing; part one appeared in AVIATSIYA I KOSMONAVTIKA, May 1990]

[Text]

No	Rank, Last Name, First Name, Patronymic	Date and Year of Birth	Left Cosmonaut Corps	Service
1	2	3	4	5
Third Group Recruited (November 1965)				
1.	Lt Valeriy Abramovich Voloshin	24 Apr 1942	9 Apr 1969	Serves in Air Force. Colonel
2.	Engr-Sr Lt Yuriy Nikolayevich Glazkov	2 Oct 1939		USSR Pilot-Cosmonaut. Deputy Commander, Cosmonaut Training Center imeni Yu. A. Gagarin [CTC]. Maj Gen Avn
3.	Lt Vitaliy Andreyevich Grishchenko	26 Apr 1942	5 Feb 1968	Served at AF Academy imeni Yu. A. Gagarin. Reserve officer
4.	Maj Med Serv Vladimir Aleksandrovich Degtyarev	9 Apr 1932	17 Jan 1966	Served at Institute of Aviation and Space Medicine. Colonel Med Serv (Res)
5.	Lt Vyacheslav Dmitriyevich Zudov	8 Jan 1942		Pilot-Cosmonaut USSR. Deputy chief, political section, CTC. Colonel
6.	Lt Leonid Denisovich Kizim	5 Aug 1941	13 Jun 1987	Pilot-Cosmonaut USSR. Serves in USSR Armed Forces. Colonel

No	Rank, Last Name, First Name, Patronymic	Date and Year of Birth	Left Cosmonaut Corps	Service
7.	Lt Petr Ilich Klimuk	10 Jul 1942		Pilot-Cosmonaut USSR. Chief, political section, CTC. Maj Gen Avn
8.	Engr-Capt Gennadiy Mikhaylovich Kolesnikov	7 Oct 1936	16 Dec 1967	Section chief, CTC. Colonel
9.	Lt Aleksandr Yakovlevich Kamarenko	8 Nov 1942	30 Apr 1969	Section chief, CTC. Colonel
10.	Engr-Capt Mikhail Ivanovich Lisun	5 Sep 1935	13 Oct 1989	Colonel (res). Director of S. P. Korolev Home-Museum in Moscow
11.	Lt Aleksandr Yakovlevich Petrushenko	1 Jan 1942	15 Jun 1973	Serves at AF Academy imeni Yu. A. Gagarin. Colonel
12.	Sgt Vladimir Yevgenyevich Preobrazhenskiy	3 Feb 1939	18 Jan 1980	Lt Col (Res). Works at CTC
13.	Engr-Sr Lt Valeriy Ilich Rozhdestvenskiy	13 Feb 1939		Pilot-Cosmonaut USSR. Directorate chief, CTC. Colonel
14.	Lt Gennadiy Vasilyevich Sarafanov	1 Jan 1942	7 Jul 1986	Pilot-Cosmonaut USSR. Col (Res). Senior scientific associate, Avtomatika, Nauka, Tekhnologiya Industrial Association
15.	Lt Aleksandr Aleksandrovich Skvortsov	8 Jun 1942	5 Jan 1968	Served in air defense units. Reserve officer
16.	Engr-Capt Eduard Nikolayevich Stepanov	17 Apr 1937		Mission specialist. Colonel
17.	Lt Anatoliy Pavlovich Fedorov	14 Apr 1941	28 May 1974	Shift supervisor and senior engineer, cosmonaut corps command group, CTC. Colonel
18.	Engr-Sr Lt Yevgeniy Nikolayevich Khludeyev	10 Sep 1940		Section chief, CTC. Colonel
19.	Lt Ansar Ilgamovich Sharafutdinov	26 Jun 1939	5 Jan 1968	Served in AF units. Reserve officer. Works as military training officer at secondary school
20.	Lt Vasiliy Dmitriyevich Shcheglov	9 Apr 1940	18 Oct 1972	Died October 1972 following grave, protracted illness
21.	Lt Oleg Anatolyevich Yakovlev	31 Dec 1940	22 May 1973	Serves in AF. Colonel
22.	Engr-Maj Boris Nikolayevich Belousov	24 Jul 1930	5 Jan 1968	Served in USSR Armed Forces. Colonel (Res)
Fourth Group Recruited (April 1967)				
1.	Engr-Maj Vladimir Borisovich Alekseyev	19 Aug 1933	20 Apr 1983	Colonel (Res). Works at Energiya Scientific-Production Association
2.	Engr-Maj Mikhail Nikolayevich Burdayev	27 Aug 1932	20 Apr 1983	Shift supervisor, Cosmonaut Corps Flight Operations Group, CTC. Colonel (Res)
3.	Engr-Maj Nikolay Stepanovich Porvatkin	15 Apr 1932	20 Apr 1983	Shift supervisor, Cosmonaut Corps Flight Operations Group, CTC. Colonel (Res)
4.	Sr Lt Valeriy Mikhaylovich Beloborodov	26 Oct 1939	29 Aug 1969	Served in AF units. Reserve officer
5.	Capt Sergey Nikolayevich Gaydukov	31 Oct 1936	4 Dec 1978	Lt Col (Res)
6.	Sr Lt Vladimir Timofeyevich Isakov	4 Apr 1940	20 Apr 1983	Shift supervisor, detachment flight operations management group, CTC. Colonel
7.	Sr Lt Vladimir Sergeyevich Kozelskiy	12 Jan 1942	20 Apr 1983	Flight operations officer, CTC. Lt Col
8.	Engr-Sr Lt Vladimir Vasilyevich Kovalenok	3 Mar 1942	3 Feb 1986	Pilot-Cosmonaut USSR. Deputy department head, USSR Armed Forces General Staff Academy. Maj Gen Avn
9.	Sr Lt Vladimir Afanasyevich Lyakhov	20 Jul 1941		Pilot-Cosmonaut USSR. Deputy directorate chief, CTC. Colonel
10.	Sr Lt Yuriy Vasilyevich Malyshev	27 Aug 1941		Pilot-Cosmonaut USSR. Deputy directorate chief, CTC. Colonel
11.	Sr Lt Viktor Mikhaylovich Pisarev	15 Aug 1941	21 May 1968	Served in AF units. Reserve officer
12.	Capt Mikhail Vladimirovich Sologub	6 Nov 1936	20 Sep 1968	Serves in AF. Colonel
Fifth Group Recruited (May 1970)				
1.	Capt Anatoliy Nikolayevich Berezovoy	11 Apr 1942		Pilot-Cosmonaut USSR. Commander, cosmonaut candidate group, CTC. Colonel
2.	Sr Lt Anatoliy Ivanovich Dedkov	27 Jul 1944	20 Apr 1983	Serves in AF. Colonel

No	Rank, Last Name, First Name, Patronymic	Date and Year of Birth	Left Cosmonaut Corps	Service
3.	Capt Vladimir Aleksandrovich Dzhanibekov	13 May 1942		Pilot-Cosmonaut USSR. Directorate chief, CTC. Maj Gen Avn
4.	Sr Lt Yuriy Fedorovich Isaulov	31 Aug 1943	29 Jan 1982	Flight operations officer at CTC. Lt Col
5.	Lt Vladimir Ivanovich Kozlov	2 Oct 1945	28 May 1973	Serves in AF. Colonel
6.	Lt Leonid Ivanovich Popov	31 Aug 1945	13 Jun 1987	Pilot-Cosmonaut USSR. Serves on AF Main Staff. Colonel
7.	Sr Lt Yuriy Viktorovich Romanenko	1 Aug 1944		Pilot-Cosmonaut USSR. Directorate chief, CTC. Colonel
8.	Entg-Capt Valeriy Vasilyevich Illarionov	2 Jun 1939		Mission specialist, Cosmonaut Corps, CTC. Lt Col
9.	Engr-Sr Lt Nikolay Nikolayevich Fefelov	20 May 1945		Mission specialist, Cosmonaut Corps, CTC. Lt Col **(To be concluded)**

Articles Not Translated

00000000 Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 90 (signed to press 29 Apr 90) p 48

Publication Data

90SV0038N Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 90 (signed to press 29 Apr 90)

[Text] English title: AVIATION AND COSMONAUTICS

Russian title: AVIATSIYA I KOSMONAVTIKA

Editor: V. V. Anuchin

Publishing house: Voyenizdat

Place of publication: Moscow

Date of publication: June 1990

Signed to press: 29 April 1990